TECHNOLOGY DEPARTMENT

McGraw-Hill Publishing Company, Inc.

First Copy

November
1929

Construction Methods

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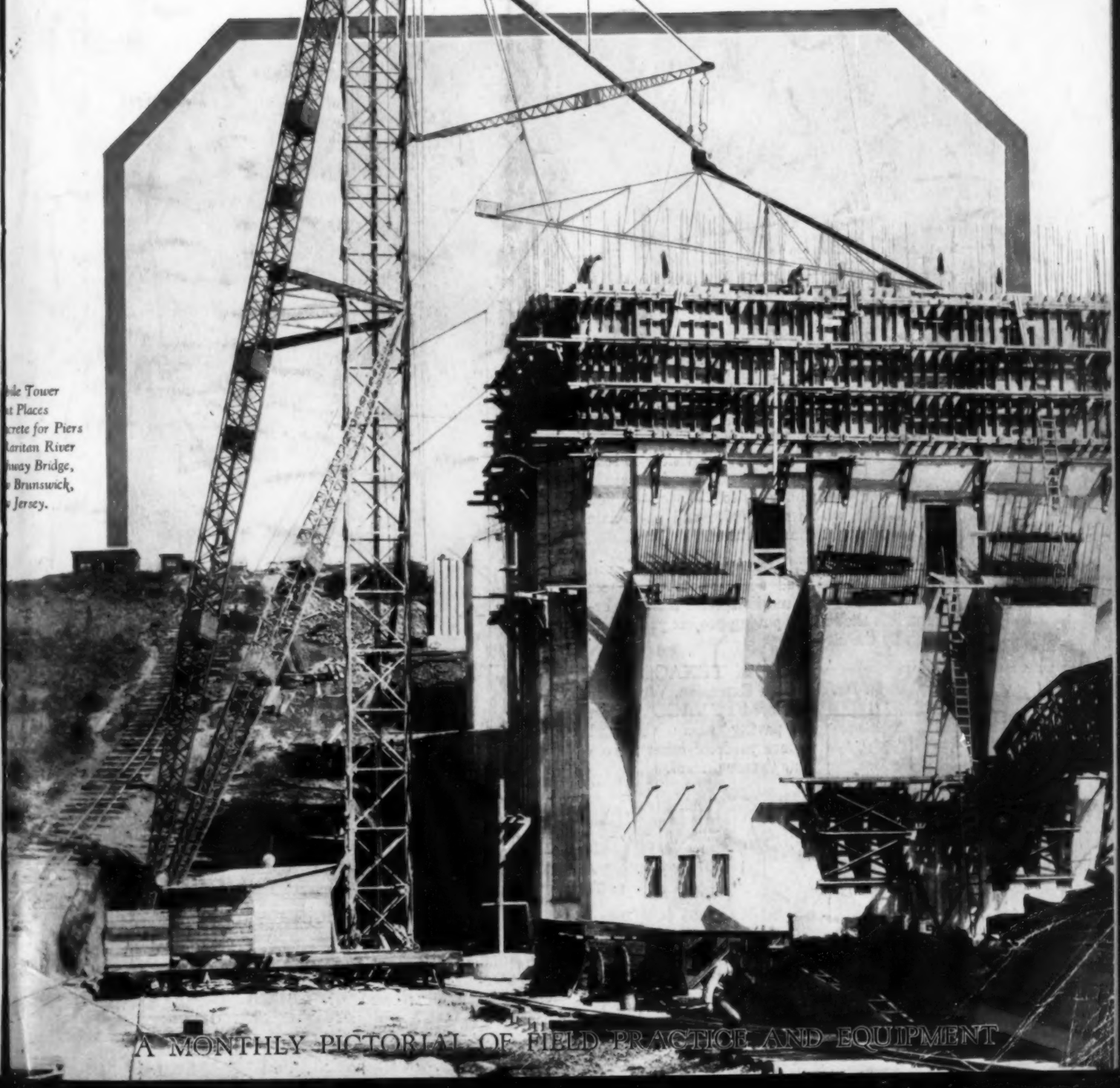

...dle Tower
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A MONTHLY PICTORIAL OF FIELD PRACTICE AND EQUIPMENT

WORCESTER'S longest *paving job*

Park Avenue Extension, Worcester, Mass. Laying binder course of TEXACO Sheet Asphalt pavement on cement concrete base.

Completed Asphalt binder course on Park Avenue Extension, Worcester. Sheet Asphalt top being laid in background.

Completed TEXACO Sheet Asphalt pavement on Park Avenue Extension, longest paving project of Worcester, Mass.

Worcester, Mass., third largest city of New England, is one of the nation's forty greatest municipalities.

The prominence of Worcester among cities of the United States would cause a visitor to look for a network of modern, well-paved streets in this city. If you have visited Worcester, you are familiar with its extensive and up-to-date system of paved thoroughfares.

In July of this year, Park Avenue Extension in Worcester was paved with TEXACO Sheet Asphalt. This job merits special mention because it is the longest paving project yet undertaken by the city.

Before the construction of TEXACO Sheet Asphalt on Park Avenue Extension, Worcester employed TEXACO Asphalt in paving many thousand square yards of other important thoroughfares.

ROAD SHOW

American Road Builders' Assn.
Atlantic City, N.J.

Jan. 13-18, 1930

TEXACO
ASPHALT

The Texas Company, U. S. A.
ASPHALT SALES DEPARTMENT
17 Battery Place New York City

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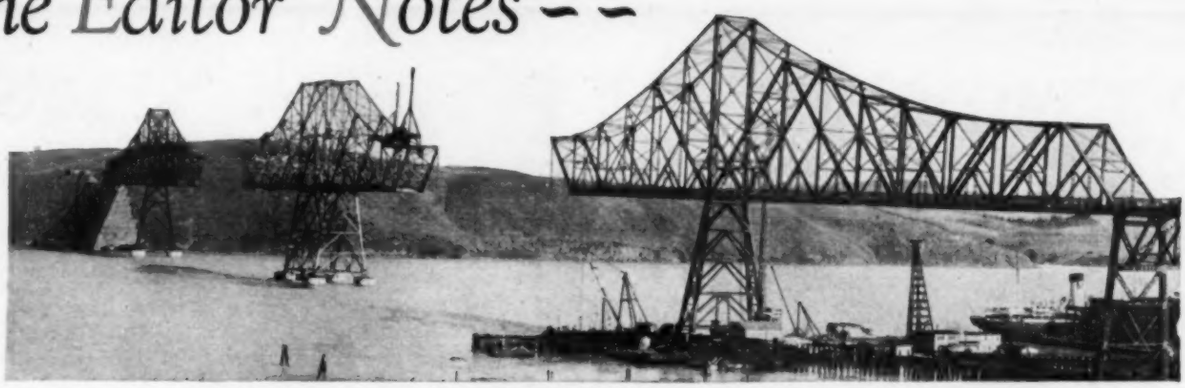
CONSTRUCTION METHODS. November, 1929. Vol. 11, No. 11. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. Two years for $1; per copy, 5 cents. Entered as second-class matter, October, 1926 Issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 5, 1879. Printed in U. S. A.

TECHNOLOGY DEPT

The Editor Notes - -



Safety Pays Dividends

"NO BUSINESS problem responds more certainly to good management than that of accident prevention, nor gives greater returns for the time and money spent on it. This fact is recognized in our compensation experience rating plan under which the contractor's insurance rates are adjusted from the manual or base rate of the classification according to the individual contractor's experience. In Wisconsin we have some contractors who enjoy reductions of from 20 per cent to 60 per cent in the premium rate charge as compared with the average premium rate charge for the classification in which their construction operations belong. On the other hand, there are contractors whose experience has been bad for several years in succession with the consequent increase in their compensation rate to the point of making them 20 per cent to 60 per cent higher than the manual rate for the classification in which their operations belong." *R. G. Knutson, Member of the Wisconsin Industrial Commission.*

Wisconsin's record is not unique. Constructors in all parts of the country have learned the economic value of intensive safety work. Insurance companies generally base the contractor's insurance rate on weighted averages of his past few years' experience, the last year being given the greatest weight. Reduction of 40 per cent in a compensation insurance rate of 7 per cent on the annual pay roll is a saving worth making, and it is made by many good concerns in the building field.

Longer Pipe Piles for Foundations

Employment of concrete-filled steel piles for building foundations in greater lengths is forecast by a proposal which the Merchants' Association's General Committee on the Revision of the New York City Building Code has received from its Subcommittee on Foundations, composed of seven well-known foundation engineers and contractors. The general committee's report is being written at the request of Mayor James J. Walker.

The subcommittee's proposal states: "Under the provisions of the present Code, piles of this character cannot be used where their length much exceeds 40 ft., because of the fact that only one splice is allowed. It has been recognized that piles of this character and of much greater length could safely be used, and, therefore, provision for such use has been made, allowing any number of splices, but with a proper reduction, for each splice, in the load capacity of the pile."

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication
Tenth Avenue at 36th Street, New York

Coming
In December

The first of a series of articles on Earth-Moving Methods and Equipment in Mississippi River Flood Control Work will appear in the next issue. Robert K. Tomlin, editor of *Construction Methods*, is now in the Mississippi Valley gathering a harvest of photographs and data to spread before the eyes of interested readers. His articles will offer construction men reliable and readily intelligible information on which to base comparisons of the multitude of earth-moving methods being used in levee building.

Climate vs. Contractor

A RECENT tabulation of data collected by the American Road Builders' Association under the direction of C. N. Conner, executive engineer, reveals interesting facts regarding the average number of working days which highway contractors may expect in all parts of the United States. The figures quoted are exclusive of Sundays and holidays.

For grading operations, working days range from 140 to 300; for paving, from 100 to 300. In northern Louisiana, for example, with a mean annual precipitation of 49.32 in., a mean temperature range of + 107 to —2 deg. F., and mean frost dates of April 20 and Oct. 20, the contractor may count on 225 days for grading and for paving. In Massachusetts, on the other hand, where average frost dates are June 5 and Sept. 10, the bidder is unduly optimistic if he expects more than 150 paving days, although 225 are reported suitable for grading.

Central and eastern Georgia, credited with 300 days fit for grading and for paving, lead the list in length of working season; northern Minnesota is among the least favorable sections, reporting 150 days for grading and 100 for paving. Minnesota's figures can be explained by the frost dates, June 15 and Sept. 1; but Georgia's record is hard to understand, in view of the high precipitation, 49.44 in., and average dates of first and last frost, Oct. 15 and April 20.

Study of the table by contractors may well result in their using more caution when estimating the number of days in a working season.

Saving Men and Money

On pp. 42 and 43 of this issue, photographs of safety practices appear for the fifth time in as many months. If you still doubt the practical value of safety work, take a glance at the text on those pages and at the leading editorial on this page.

To Produce More per Person at Work

IN discussing the recent upset in the stock market, Dr. Julius Klein, Assistant Secretary of Commerce, submits this cogent comment:

> "The fundamental cause of the expansion of business and the improvement in standards of living has been the growing efficiency of production. We have been able to produce more and more goods and services per person at work. This gain in efficiency in turn has been due to causes . . . that enter into the very foundations of our economic structure.
>
> "The steady spread of education is perhaps the most basic of these upward-pushing forces. Closely allied with this is the growth of scientific research with its harvest of inventions and discoveries. The abundant savings of our people, with the consequent expansion of our capital, have enabled us to provide more and better equipment for production, thus reducing costs.
>
> "One could readily name other basic factors that have contributed to our progress . . ."

If Dr. Klein had gone on to name some of these "other basic factors" he would have ranked foremost among them the worth-while technical and industrial journals. For they are, by long odds, the most effective agencies now at work to promote the "spread of education" amongst the responsible men of industry, to broadcast the "harvest of inventions and discoveries" and to keep production men in every field abreast of the need for "more and better equipment."

In every issue, in both its editorial and advertising pages, *Construction Methods* is trying to do its share of this all-important job.

Willard Chevalier
Publishing Director.

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Does POWER *in the motor mean* POWER *on the* DIPPER TEETH?

POWER

Just like the modern giant locomotives have ample power to climb mountain grades—so have Byers shovels tremendous power in over-size motors, and extra heavy construction throughout, which helps the shovel through toughest digging without the sacrifice of speed!

Byers ½ yd. shovel cutting 2 ft. grade for new road project.

If it's a Byers it does! Here's why—

Direct drive utilizes maximum power; independent reversible crowd applies that power to the thrust stroke and, behind it all, Byers motors in each model are 20% larger than average shovels.

You get: 1. more power applied to the motor take off, 2. less power wasted on its way to the drums, 3. greater digging and travelling ability, 4. ability to steer and swing while traveling up or down grade.

The whole machinery deck—shafts, pinions, bearings—are built to stand these extra stresses with the result that *you get more for your money with Byers.*

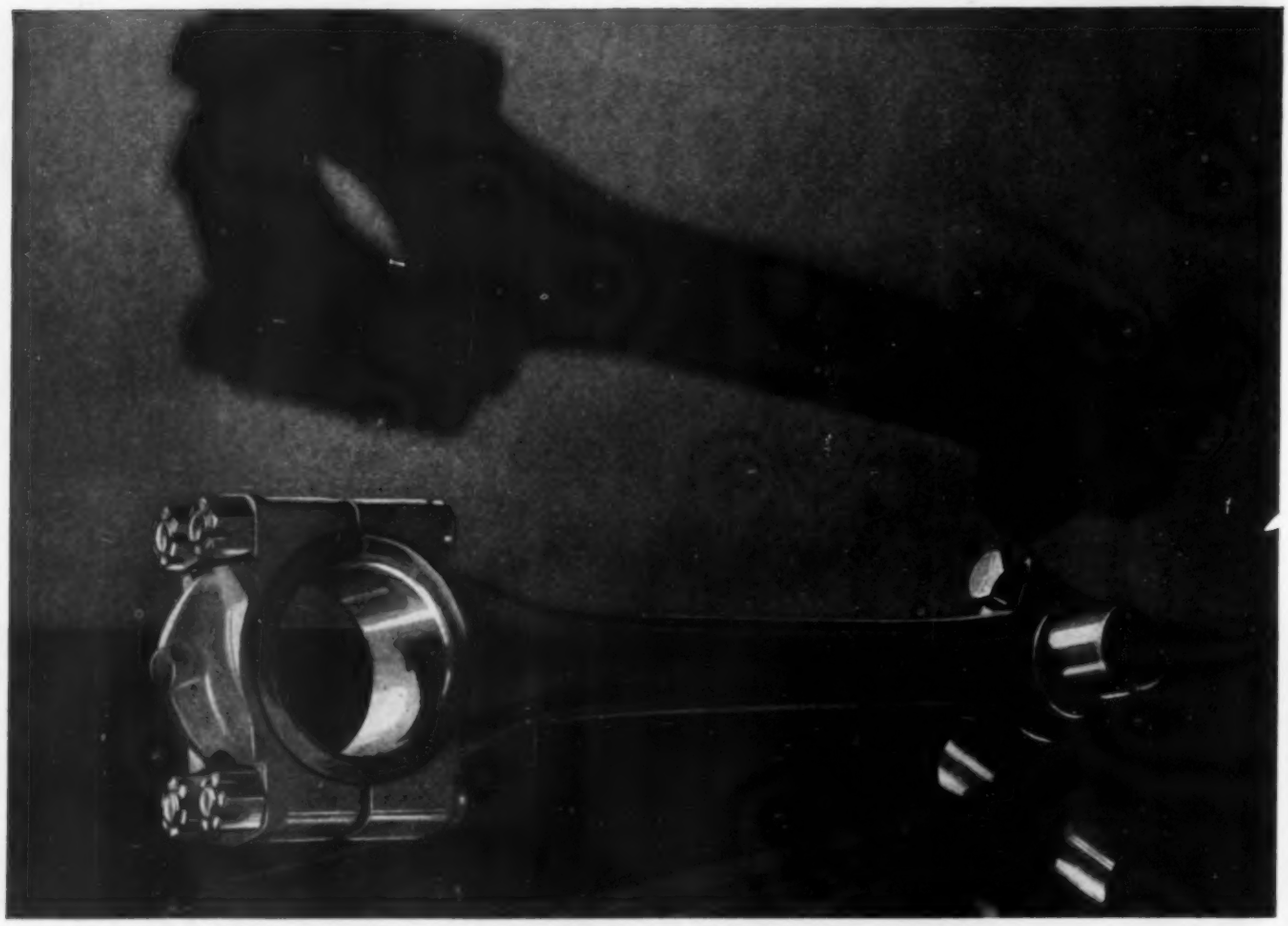
THE BYERS MACHINE COMPANY, Ravenna, Ohio

Byers ½ yd. full circle Bulldog Shovel, Crane, Dragline, Trencher, Skimmer
Byers ¾ yd. full circle Shovel, Crane, Dragline, Trencher, Skimmer
Byers 1 yd. full circle Shovel, Crane, Dragline, Trencher
Byers 1¼ yd. full circle Master Shovel, Crane, Dragline
Byers ½ yd. half circle Bear Cat Shovel, Crane, Trencher, Skimmer

SALES AND SERVICE THROUGHOUT THE COUNTRY

It's *the* Byers CROWD that does it

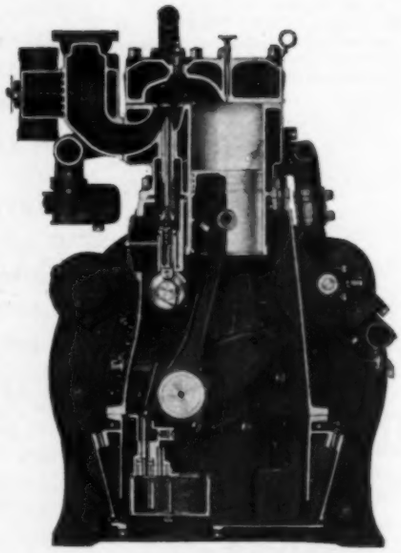
SHOVELS **BYERS** **CRANES**



true character revealed

BEFORE any connecting rod is put into a Waukesha engine it is "right." After leaving the forge shop each rod is subjected to the *special deflection test.* Even the most minute defect, either in heat treatment or quality of material, cannot "get by." It was Waukesha engineering ingenuity that devised this simplest and most positive test. . . that definitely determines the fitness of a connecting rod to stand the stress of heavy duty in the modern industrial engine. *Waukesha connecting rods stand up.*

Bearing distortion is also eliminated. The reinforced connecting rod caps are heavily ribbed and held in place by four big, special heat treated bolts. Besides this great bearing stiffness, the large end of the connecting rod is ground to fit the removable bearing. Many other reasons for the long life of Waukesha engines are given in Bulletin 556. Write *Industrial Equipment Division, Waukesha Motor Company, Waukesha, Wisconsin. Offices: New York, 8 West 40th Street; San Francisco, 7 Front Street.*



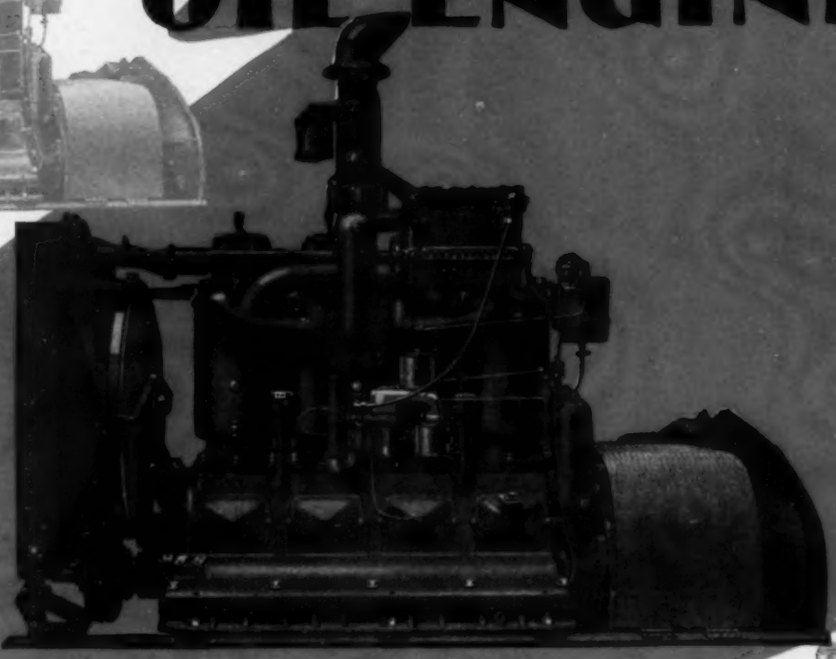
Cross Section of 4-Cylinder Super-Duty Waukesha Engine

978

WAUKESHA ENGINES

THE NORTHWEST OIL ENGINE

PAGE 5



Gasoline motor dependability

The new Northwest Oil Engine brings you gasoline motor dependability and simplicity, free from the troubles of Diesel engines, and burns low grade fuel that can be bought practically anywhere.

It eliminates buying in carload lots in many sections of the country!

No more calling for special mechanics!

No more loss of fuel through theft!

It consumes no water other than that in the radiator!

And it means a big saving in your fuel bill. Ask about this new Northwest feature.

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines

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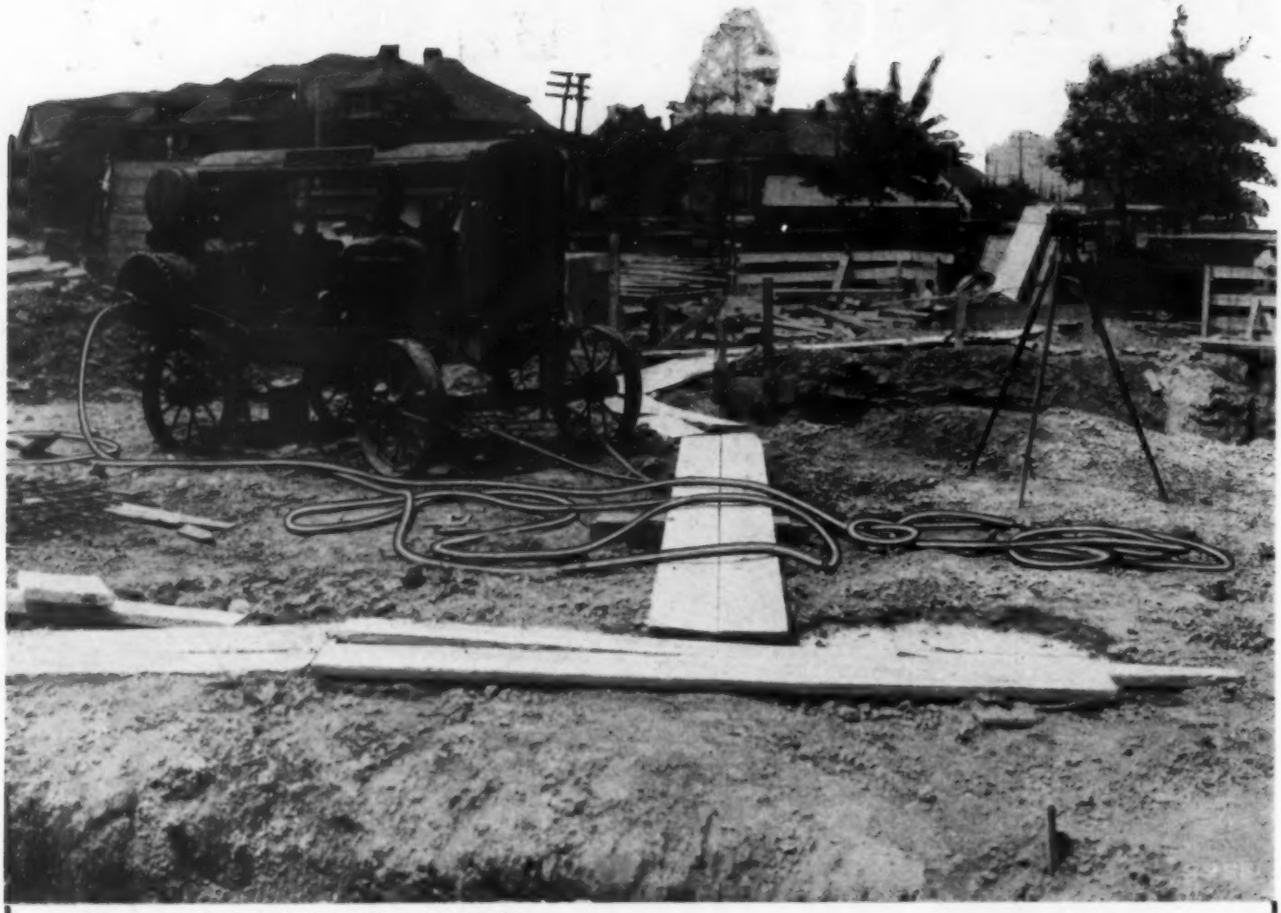
Chicago, Ill., U. S. A.

NORTHWEST



Courtesy of Contractor's Equipment Co., Detroit, Mich.

Think "Continental" when you need Air Hose

The largest contractors in the country use Continental Air Compressor, Suction, Steam, Pneumatic Tool, Welding, Water Hose and are willing to advertise the fact.

Write our nearest branch for prices and information.

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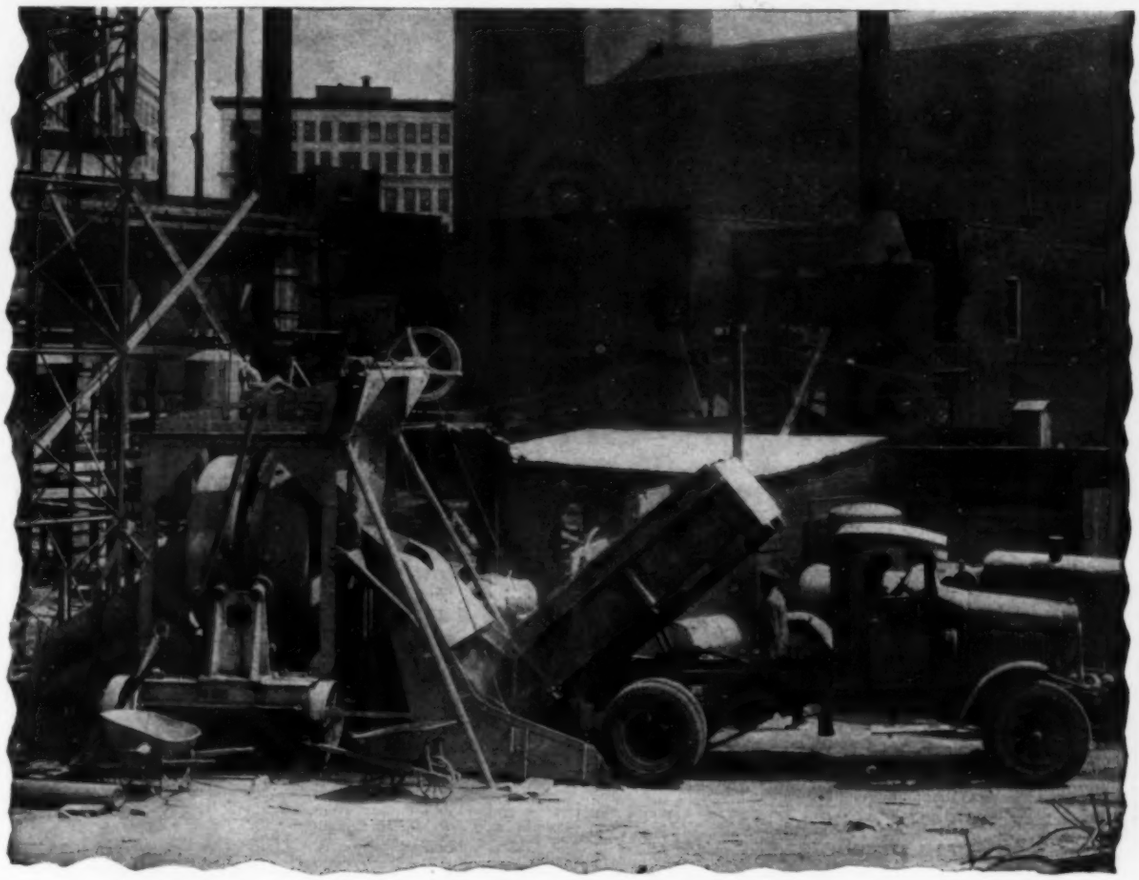
CHAS. C. KERNER, 152 Chambers Street, New York, Exclusive Foreign Representative

LAKEWOOD CONSTRUCTION EQUIPMENT



Back Right In

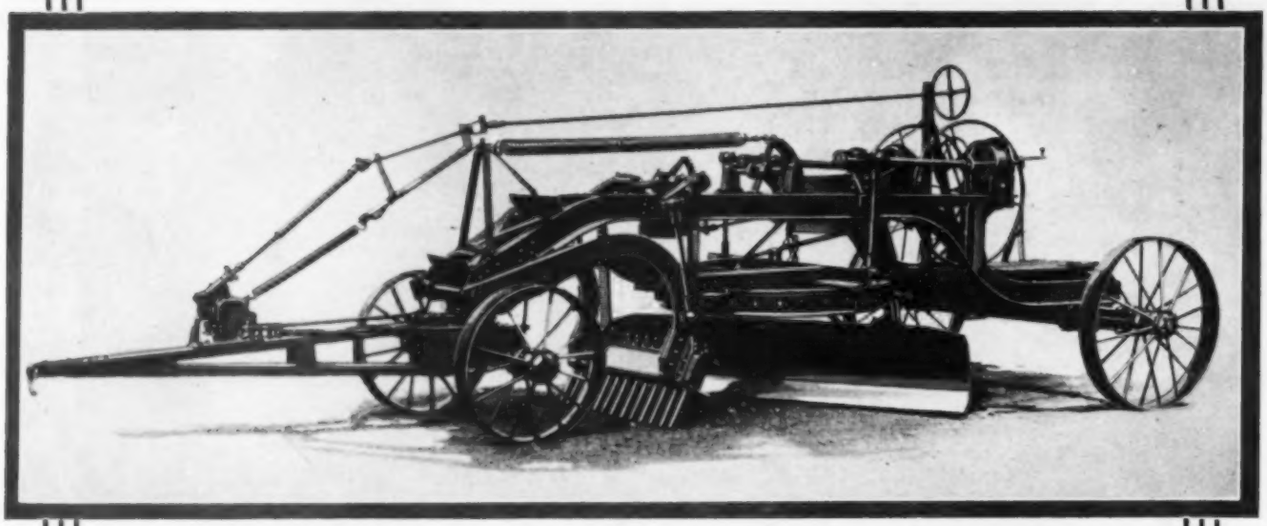
A 28-S Building Mixer with paver type skip—batch trucks dump direct—less space required—bins, buckets, elevators and ramps eliminated—it's simple—it's faster.

Photo above shows a 28-S Lakewood Mixer with paver type skip as used by the W. J. Schirmer Co. at Akron, O. Complete details in the latest Lakewood Mixer bulletin. We have a copy for you.

EXPORT OFFICES: 30 Church St., New York City - - *CABLE ADDRESS:* Brosites

LAKEWOOD

The Lakewood Engineering Co., CLEVELAND - O.



The Western No. 55 Road Grader, a sturdy unit for Road Construction and Maintenance

The Western 55 Grader

is a strong machine for both construction and maintenance

Though designed for use as a road building machine, the Western 55 Grader has the weight and handling ease needed in a heavy maintenance unit.

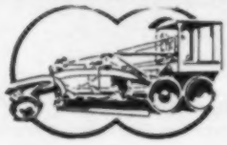
Capable of working behind tractors rating up to 40 horse-power, the 55 is an ideal two-purpose machine. It is outstanding for its great strength and flexibility.

A few refinements have recently been made that close study and experience have suggested. These include: increased weight in certain members—added reinforcing to increase rigidity — an improved blade lift—improved front and rear axles and a stiffened tongue in the offset engine hitch.

The Western 55 Grader weighs 6200 lbs. Standard equipment includes Alemite lubrication and Timken bearings. It can be equipped with scarifier or back sloper attachments. For complete information on this and other models, write the Austin-Western Road Machinery Co., 400 North Michigan Avenue, Chicago, Illinois. Branches in principal cities.

1930 CONVENTION & ROAD SHOW
A. R. B. A.
ATLANTIC CITY N.J.
JAN. 13-18

Austin-Western
ROAD MACHINERY

THE NEW  DUAL DRIVE

WORLD LEADERS

IN THE SMALL SHOVEL FIELD

½ to 1¼ CU. YARDS

It is logical to expect that Bucyrus-Erie, world's largest exclusive manufacturers of excavating machinery, would have special facilities for the production of small equipment.

Separate factories, and a separate engineering organization of outstanding ability, are maintained for the sole manufacture of small excavating units — Gas, Diesel, Electric, Gas + Air and Diesel + Air. In addition, this small-unit division is privileged to draw on the sum-total experience of the Bucyrus-Erie organization.

Still more impressive is the fact that Bucyrus-Erie has more machines actually operating in the field than any other manufacturer of excavating machinery. Suitability for the job — and dependability in operation — are traditional features of Bucyrus-Erie shovels, large and small. And Bucyrus-Erie Service extends to every part of the civilized world!

Write for bulletin on the size of equipment you need.

BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

Plants: South Milwaukee, Wis., Erie, Pa., Evansville, Ind. General Offices: South Milwaukee, Wis.
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Representatives throughout the U. S. A. Offices and distributors in all principal countries.

OE-11-29-CM

Ransome 7-S Standard Building MIXER

YOU GET THE MOST

There's no doubt about it. In the Ransome 7-S Standard Building Mixer you get the most for your money because *contractors* were really the ones who built it. From all sides, right from the field, came suggestions. Contractors told us what they wanted—

"A mixer that will stand up .... Long Life .... Light in weight .... Portable .... Easily Operated .... Simple to lubricate .... Large output in fast time .... Same improved water control you put on your large mixers."

These and many other suggestions wrote the specifications for the Ransome 7-S. Point for point there's a tremendous value in this job. Everything contractors want is here. It's big value clear through with every requirement satisfied.

You get the most in the Ransome 7-S.

May we send you Bulletin 123 ?

RANSOME — AMERICA'S FIRST MIXER

Ransome Concrete Machinery Company

1850—Service for 79 Years—1929

Dunellen **New Jersey**

A Mouthful At Every Bite

... With a habit of cleaning up the Job

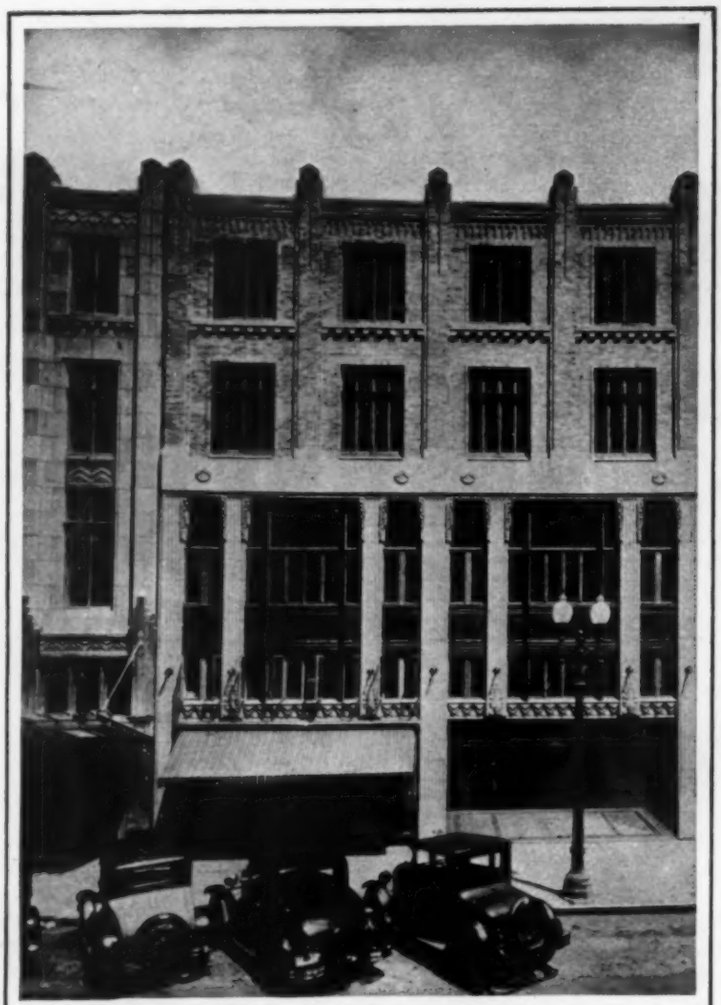
Faster output, and thorough results—that's typical of the Type "S" Owen Rehandling Bucket. On the job it demonstrates the Owen Guarantee in record time—"A Bigger Day's Work than any other Bucket of the same weight and capacity." Nothing left for the usual clean-up after the Type "S" finishes. That's why it's such a money saver on barges and cars. Write for a Type "S" Folder and read more about how this bucket eats up the job.

THE OWEN BUCKET COMPANY
6023 Breakwater Ave. Cleveland, O.

OWEN BUCKETS
INSURE A BIGGER DAY'S WORK

Owen Buckets

12 Days Saved



The Finnegan Building, Houston, Texas.

THE contract for the new Finnegan Building, Houston, Texas, called for completion in 50 days. In order to save time the contractors, The T. B. Hubbard Construction Company, Houston — who had selected LONE STAR Cement for this job because of its high quality and dependability—decided to use *"INCOR" Brand Perected High-Early-Strength *Portland* Cement for the second floor slab.

Mr. T. B. Hubbard states that the "INCOR" Concrete floor slab was ready for use 24 hours after the concrete was placed—with a resulting saving of 12 days construction time. This enabled him to complete the building on schedule.

Instances such as these, reported by contractors and builders throughout the United States, demonstrate the value of the recommendation: "Use LONE STAR Cement for all concrete construction work where time is not the principal factor; use 'INCOR' for work that's in a hurry." "INCOR" Brand combines the outstanding quality of LONE STAR Cement with high-early-strength and produces rugged, dependable *Portland Cement* concrete ready to use in 24 hours. "INCOR" contains no admixtures, requires no special methods of handling.

Use "INCOR" Brand for your next concrete construction job where time means money!

* Registered U. S. Pat. Off.

INTERNATIONAL CEMENT CORPORATION

342 Madison Avenue, New York

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URUGUAY PORTLAND CEMENT COMPANY
Montevideo, Uruguay

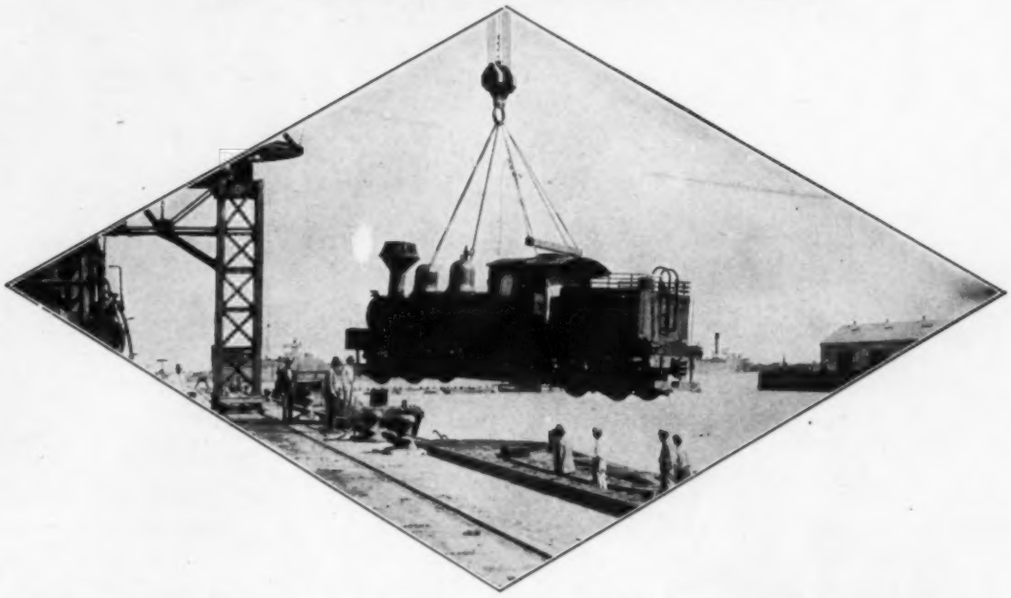
One of the world's largest cement producers—13 mills . . . total annual capacity 21,000,000 bbls.

"HERCULES"

RED-STRAND

REG. U.S. PAT. OFF.

WIRE ROPE



For Hard Work of All Kinds

Wherever wire rope is used for hard work; when or where conditions make strength and wearing qualities necessary; when safety is a vital factor—then and there is where "HERCULES" (Red-Strand) will give a good account of itself.

This wire rope is made of acid open-hearth steel wire and every wire used is first rigidly tested by us to make sure that it comes up to our exacting specifications. Furthermore, it is made in both Round Strand and Patent Flattened Strand construction in order to meet all working conditions.

If you will tell us how you use wire rope we shall be glad to suggest the construction we consider best for your work.

Made Only by **A. Leschen & Sons Rope Co.** Established 1857

5909 Kennerly Avenue
ST. LOUIS

New York Chicago Denver San Francisco

The new Ready Mixed Concrete Plant furnished for the Bridges Asphalt Paving Company in St. Louis, Mo., is equipped with a Blaw-Knox 110 Ton 3-compartment Weighing BATCHER-PLANT, and an 8000 cu. ft. four compartment Blaw-Knox Cement Bin to handle the four different brands of cement required.

The entire plant layout was designed by the Blaw-Knox Engineering staff.

STEEL BINS

MEASURING EQUIPMENT (VOLUME, WEIGHT, or INUNDATION)

BATCHED MATERIAL PLANTS

CENTRAL MIXING PLANTS

READY MIXED CONCRETE PLANTS

Agitator TRUCK BODIES

Put it up to BLAW-KNOX

Meet Us at the 27th Annual **ROAD SHOW** Atlantic City Auditorium Jan. 11 to 17, 1930

Contractors have learned to rely upon the experience and ability of Blaw-Knox to furnish efficient plants for ready mixed concrete and for central mixing.

A striking example of this is the recently completed ready mixed concrete plant of the Bridges Asphalt Paving Company at St. Louis, Mo., illustrated above.

Blaw-Knox Engineers have designed and built many Ready Mixed Concrete Plants throughout the United States, and they point with pride to the thousands of Blaw-Knox Central Mixing BATCHERPLANTS on construction jobs, large and small, involving the use of Blaw-Knox Volume Batchers; Weighing Batchers and the well-known Blaw-Knox Inundation System.

Permit Blaw-Knox to make recommendations for your Central Mixing Plant or Ready Mixed Concrete Plant. You will be placed under no obligation if you avail yourself of this valuable engineering service.

BLAW-KNOX COMPANY

2086 Farmers Bank Bldg., Pittsburgh, Pa.

BLAW-KNOX

New York	Cleveland	Birmingham
Chicago	Detroit	Boston
Philadelphia	Baltimore	Buffalo

Announcing
McKIERNAN-TERRY CORPORATION

A Consolidation of

McKiernan-Terry Drill Company
National Hoisting Engine Company
and Steele & Condict, Inc.

ON November First, the McKiernan-Terry Drill Company changed its corporate name to McKiernan-Terry Corporation and acquired ownership of and became the successor to the National Hoisting Engine Company of Harrison, N. J. and Steele & Condict, Inc., of Jersey City, N. J.

The consolidation of three firms with products going into the same fields has been effected to provide adequately for greater business expansion.

The National Hoisting Engine Company and Steele & Condict, Inc., will preserve their identity to the extent that they will operate and be known as Divisions of the McKiernan-Terry Corporation, but with executive activities transferred to the sales offices of the new corporation in New York.

For economic reasons, work previously done at the plant of Steele & Condict, Inc. will be transferred to and divided between the McKiernan-Terry plant at Dover, N. J. and the National Hoisting Engine Company plant at Harrison, N. J.

Both these latter plants have already been substantially enlarged and further building expansion and increases of tool equipment are pending.

The prestige of the predecessor companies, dating back from one-quarter to two-thirds of a century, came from painstaking efforts to produce the best, to market at reasonable price, and to serve faithfully.

The McKiernan-Terry Corporation intends to uphold the same traditions and policies, and seeks to retain the good will of its customers which it has earned in years past by maintaining the excellence of its products, by dealing fairly, by rendering prompt service, and by continuing friendly interest in all outstanding equipment regardless of age.

McKIERNAN-TERRY CORPORATION
14 Park Row, New York
Distributors in Principal Cities

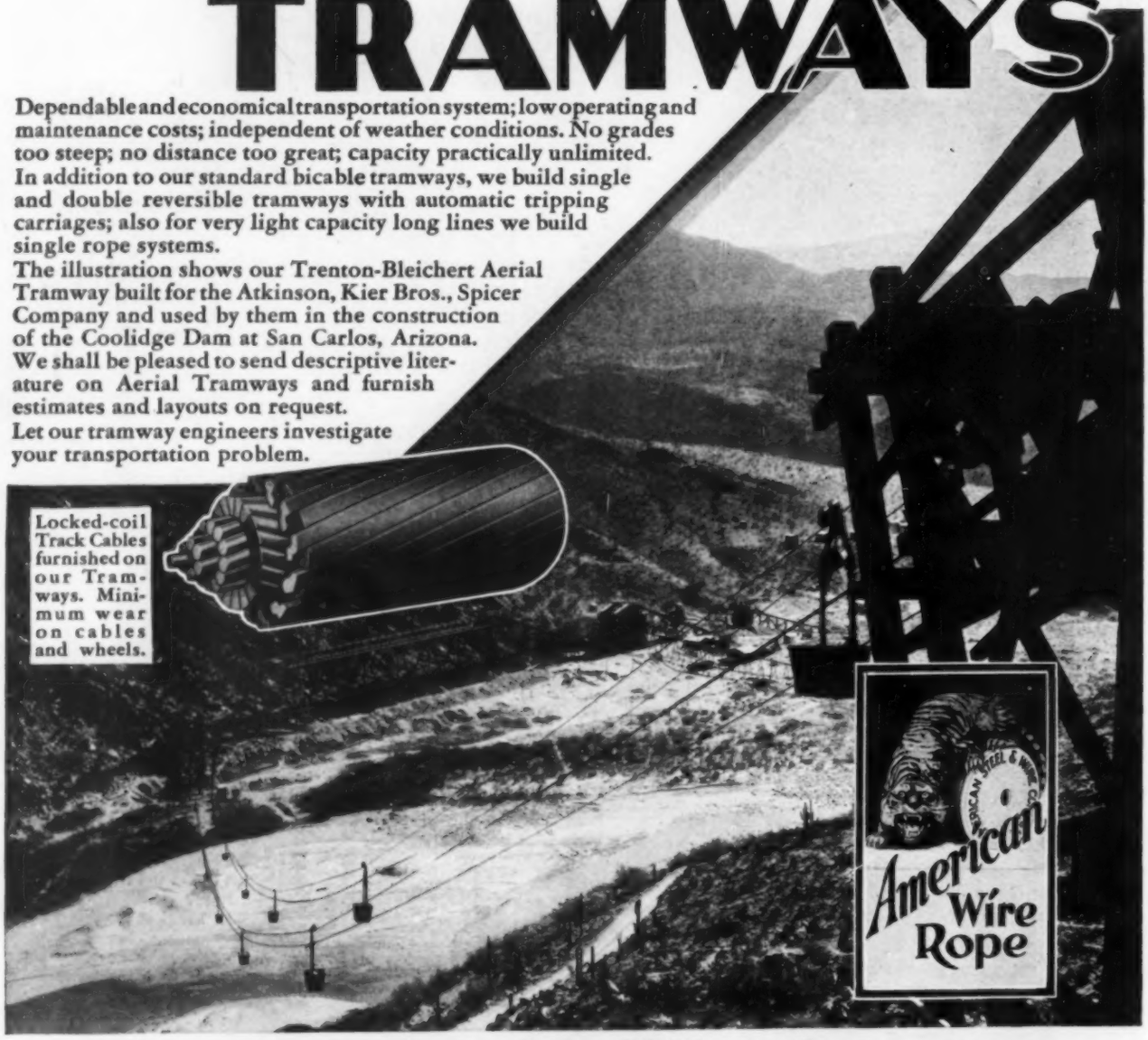
No Grade too Steep
No Valley too Wide
for American Steel & Wire Company

AMERICAN
TRENTON-BLEICHERT SYSTEM

Aerial
TRAMWAYS

Dependable and economical transportation system; low operating and maintenance costs; independent of weather conditions. No grades too steep; no distance too great; capacity practically unlimited.
In addition to our standard bicable tramways, we build single and double reversible tramways with automatic tripping carriages; also for very light capacity long lines we build single rope systems.
The illustration shows our Trenton-Bleichert Aerial Tramway built for the Atkinson, Kier Bros., Spicer Company and used by them in the construction of the Coolidge Dam at San Carlos, Arizona.
We shall be pleased to send descriptive literature on Aerial Tramways and furnish estimates and layouts on request.
Let our tramway engineers investigate your transportation problem.

Locked-coil Track Cables furnished on our Tramways. Minimum wear on cables and wheels.



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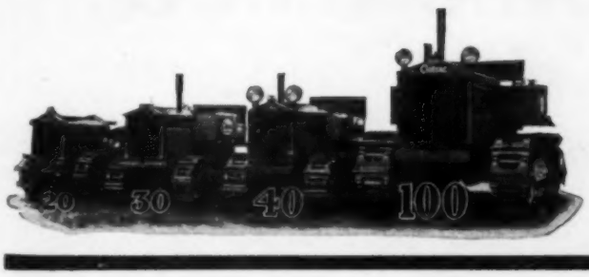
Cletracs Make Every Job Faster, Better and More Profitable!

IT'S an easy matter to weigh the value of Cletrac Crawler Tractors. WATCH 'EM WORK! Watch them handle the big loads—clock their speed—note their sure traction in the soft spots—see them master ditches and slopes—count the seconds (not minutes) it takes to oil them with the patented "One-Shot" system—check with the driver on the astonishingly low gas and oil consumption. One hour of observation like this will convince you of some big facts that a whole book of information cannot prove.

There is no doubt about it, Cletracs make every job faster, better and more profitable—and there are many thousands of them accomplishing just that every day for their owners.

There is a Cletrac distributor near you. See him or write us for the story.

THE CLEVELAND TRACTOR CO., 19323 Euclid Ave., Cleveland, Ohio



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Send your catalog and literature on Cletracs for all types of industrial work.

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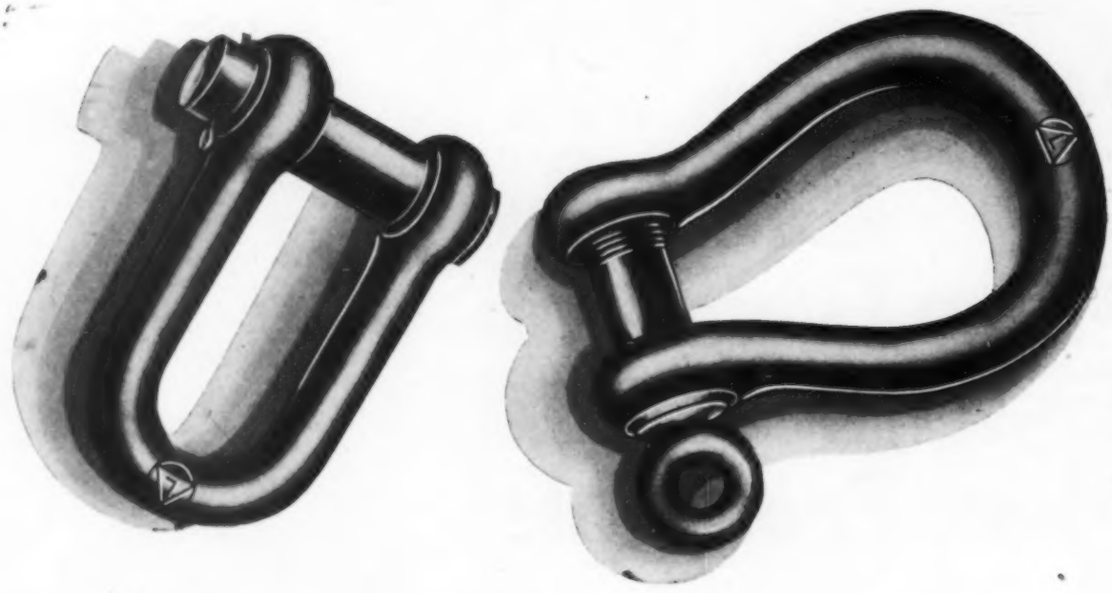

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of drop forged steel—galvanized or japanned. A full line of screw and round pin shackles, swivels and other wire rope and chain fittings in standard sizes. Look for the Laughlin trade mark.

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It will get your sheeting down to where you want it—*fast* as you want it.

Strikes 475 powerful blows a minute. Low air consumption. Weighs 220 lbs. Designed for 3-inch wood sheeting.

For 2-in. sheeting use the Midget, it weighs only 97 pounds. Over 550 blows of 90 foot pounds each per minute.

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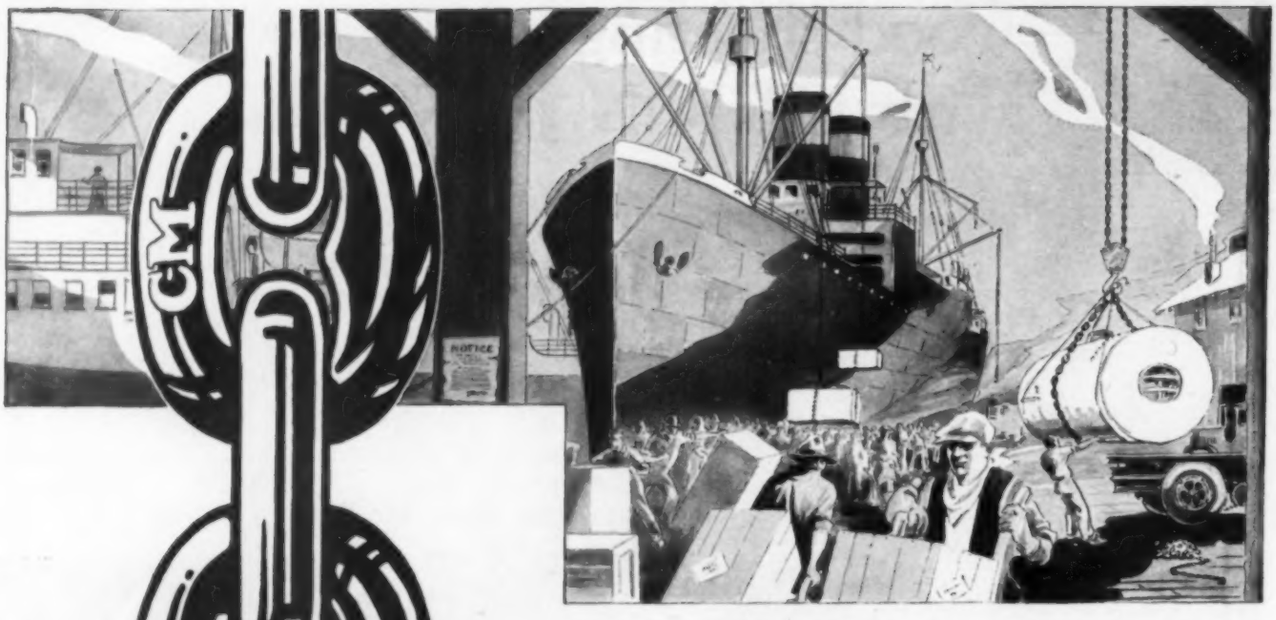

EXTRA STRENGTH

In construction, transportation and every form of industry "Inswell" Chains play an important part.

Important, because their added strength means added safety, extra speed, all around better service.

The basic reason is the patented process "Inswell" an inside swell on every link of C. M. chain. It signifies a stronger chain of stronger links . . . a chain tougher than the toughest job . . . a chain into which are built years of extra service.

Remember C. M. when you buy your next chain!

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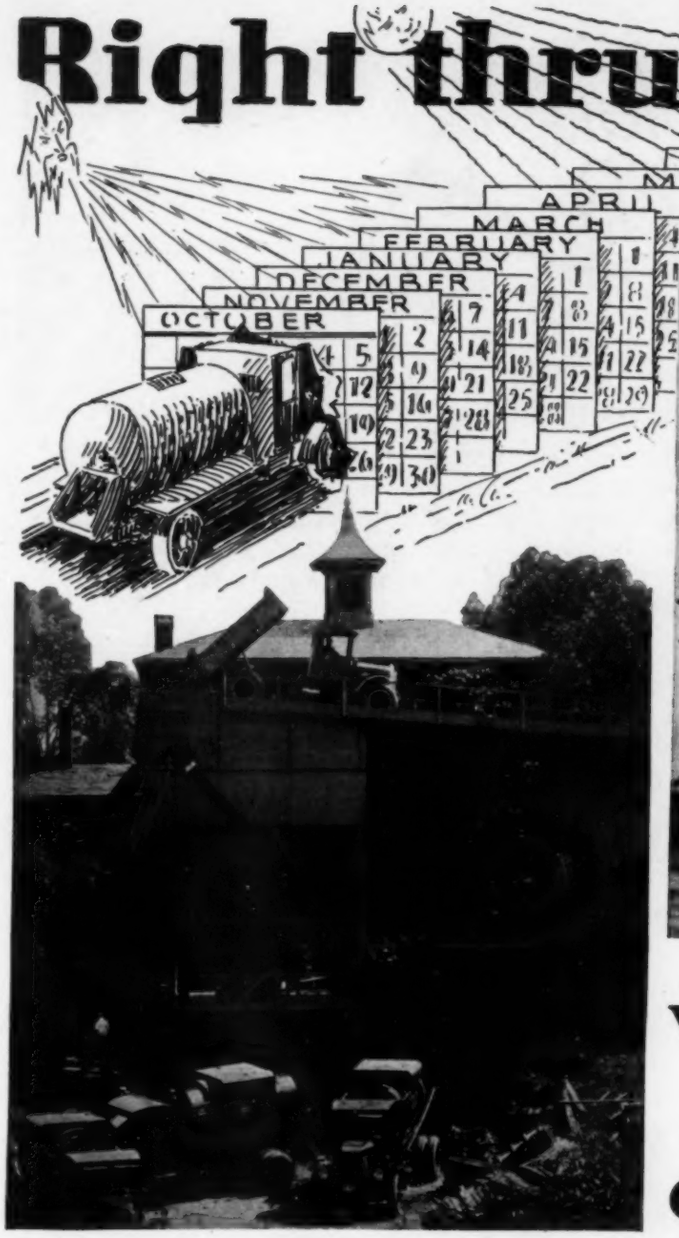
"INSWELL" ELECTRIC WELD CHAIN

Right thru the year-

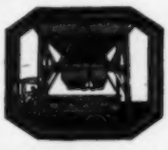


with a BUTLER Commercial Concrete Plant

Commercial concrete production is a year 'round business.

Butler Plants—for central mixing or transit mixing—are in successful operation in all parts of the country. Each Butler Commercial Concrete Plant is giving typical Butler satisfactory service.

Our engineering department is in close touch with commercial concrete developments and will be glad to consult with you at any time.



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Representatives in fifty principal cities

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The Most Popular ARC WELDER ON THE MARKET

THE MORE YOU
ARC WELD
THE MORE
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It's the simplest, most substantial, and best-looking set built. Liberal use of high-grade materials, fine workmanship, and good design—inherent in all G-E products—are apparent at a glance. It is a self-excited set—that means no separate exciter to look after.

No other arc welder excels it in speed of welding or deposition of metal. Infinitely small gradations of welding current can be obtained simply by turning a handle. It is extremely easy to operate and will give 24-hour service day after day. And we back our reputation against its ability to meet N.E.M.A. and N.E.L.A. ratings—at any time.

A call to your nearest G-E office will bring you complete information.

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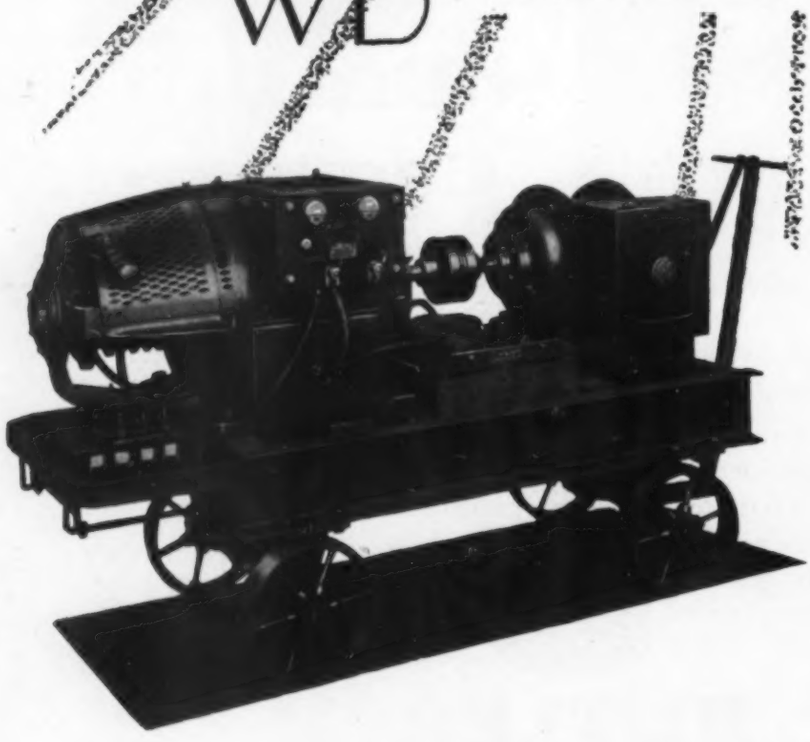
WD



G-E welding electrodes—when used with Type WD arc welders—produce strong, smooth welds at great speed.

530-58

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Universal Truck Crane operating with skip boxes, digging 30 ft. pier holes on the $10,000,000 Pennsylvania Warehouse, Jersey City.

1929 JOBS
DONE ON TIME

RIGHT NOW when you want to keep your big equipment going steadily, to complete this year's contracts on time, a Universal Truck Crane can save you a lot of expense and worry.

Here is a machine that can travel at motor truck speed, taking care of the cleanup work, from one end of the job to the other.

You can use it to unload a car of supplies, for road ditching and berming, or bridge building. You can send it to pull up forms, remove a slide or slip, dig footings, or for any of the hundred and one short jobs that ordinarily slow things up.

If you haven't enough work to warrant the purchase of a machine now, you can rent a Universal Crane from your local crane service company, to tide you over until spring.

THE UNIVERSAL CRANE COMPANY
Lorain, Ohio

A quick and economical way to take care of "V" ditching and berming.

Aggregate for 8000 cu. yds. of concrete was loaded into this bin by the Schadwell Crane Service Company's Universal Truck Crane.

Steel for this type of building is easily erected with these two Universals. 1400 tons were set in 25 crane days.

1930 CONVENTION ROAD SHOW A.R.B.A. ATLANTIC CITY, N.J. JAN. 13-18

UNIVERSAL

AND NOW A MARION DIESEL-ELECTRIC

TIDEWATER Timber Co. of Portland, Oregon, finds in this new shovel all the economy of the Diesel with the fine operating characteristics of the steamer. Ask for full details.

THE MARION STEAM SHOVEL CO.
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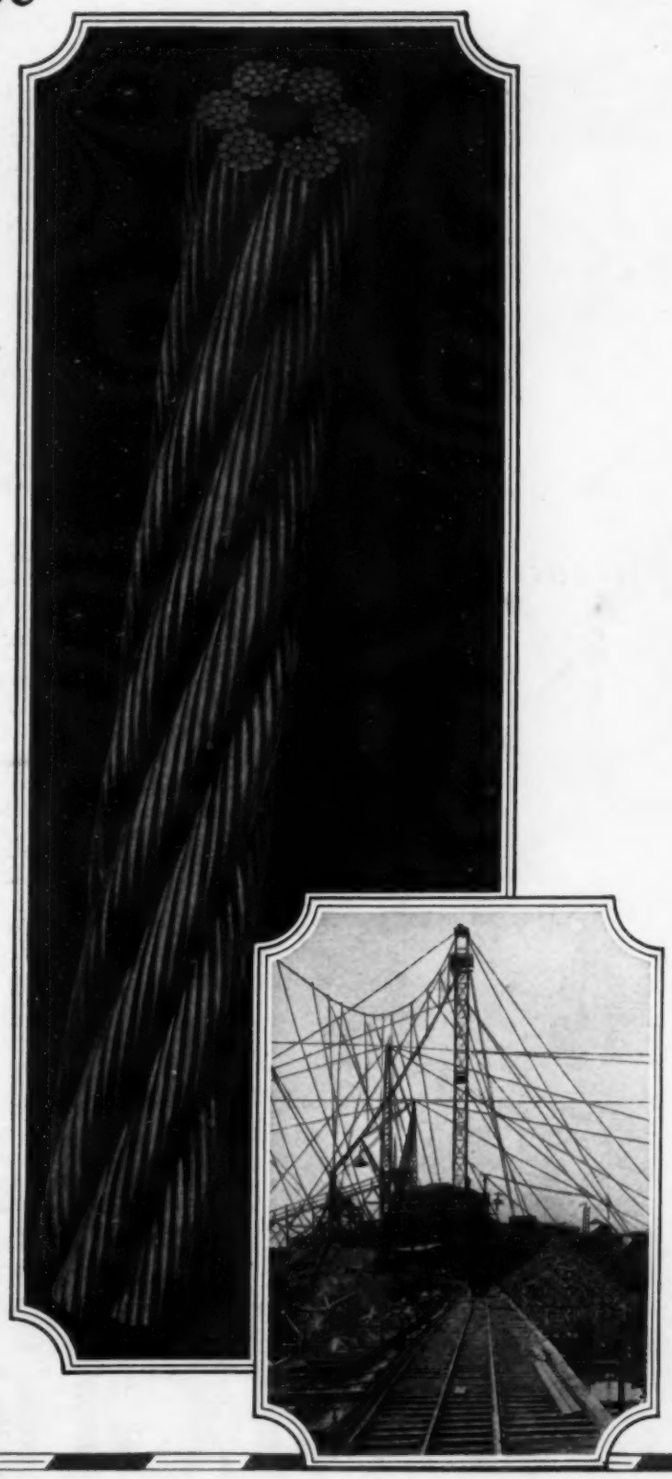
Roebling

"Blue Center" Steel Wire Rope



When you purchase Roebling "Blue Center" Steel Wire Rope, you get more than simply wire rope.

You buy a superior grade of steel wire, fabricated into rope by skilled workmen.

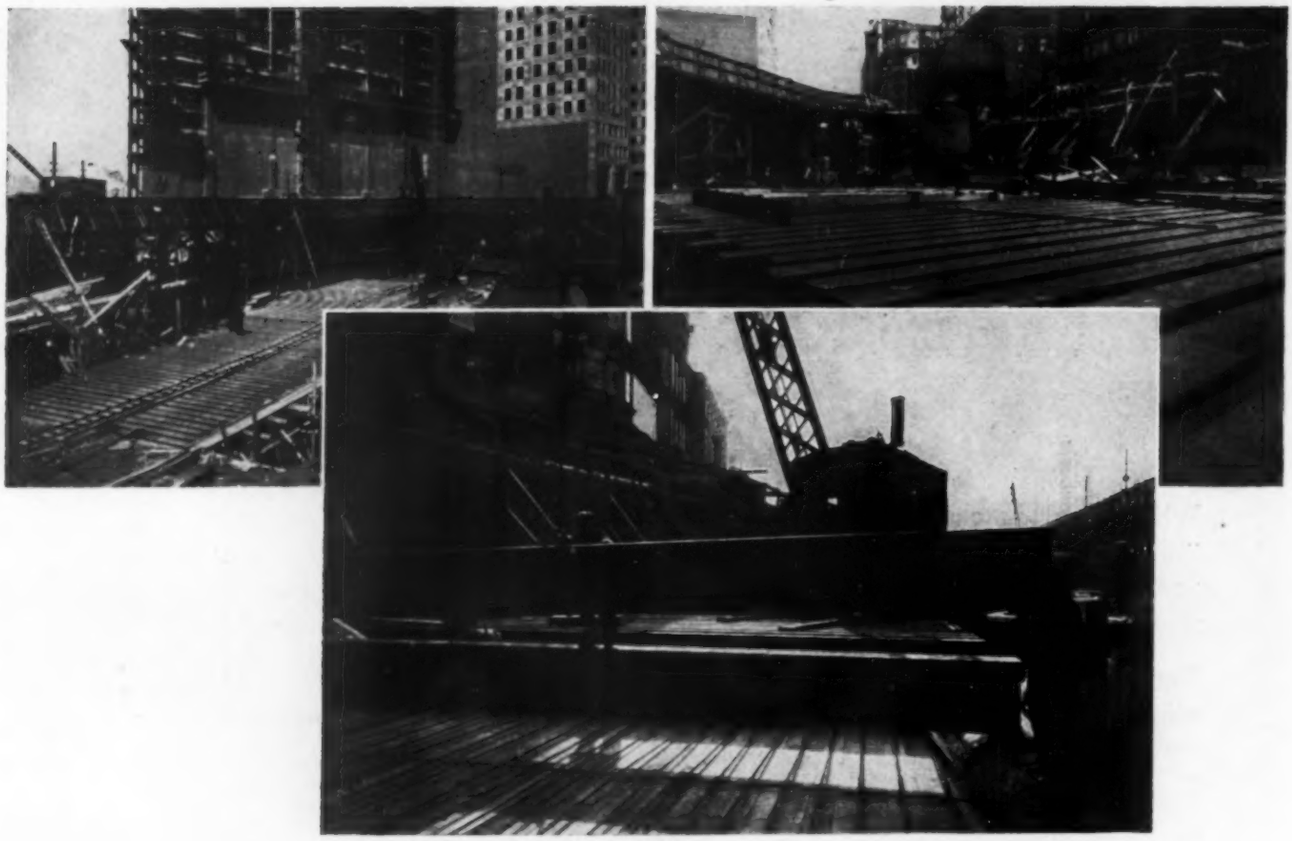
You get the concentrated efforts of the best engineering and metallurgical skill obtainable from over 80 years of wire rope manufacture.

You get rope which from the molten metal to the finished rope, is manufactured under Roebling supervision and subjected to exacting tests in all stages of manufacture.

For these reasons it is the most economical rope to buy for severe conditions. A trial of "Blue Center" on your heavy duty work will convince you of the truth of these statements.

John A. Roebling's Sons Company

Trenton **New Jersey**



Approaching the Cleveland Union Terminals

TO GAIN access to the new Cleveland Union Terminals from the east, it was necessary to construct a subway under a portion of Ontario Street for approximately a half-mile. Reinforced concrete walls and abutments support two levels, and at places three levels, of railroad tracks. The upper two levels are supported by 30″ Carnegie Beams encased in concrete. The photographs show the spacing of these beams. The work is being done by the Bates and Rogers Construction Co.

In subways, bridges and buildings of every description Carnegie Beams are imparting to structural steel new possibilities, especially with the recent introduction of a new column section, CB-61, designed particularly for limited clearances in subway construction. This section is rolled in six different weights from 40 to 80 pounds per foot. The flange widths range from 9.50″ to 10.046″, and the depth of the section from 5.75″ to 6.842″. The radii of gyration about the major and minor axes are practically identical. This unusual section saves a vast amount of fabrication.

*The handbook—"*CARNEGIE BEAM SECTIONS*"—will acquaint you with complete details. Copy will be sent at your request.*

CARNEGIE STEEL COMPANY

Subsidiary of United States Steel Corporation

PITTSBURGH, PA.

35

CARNEGIE BEAMS

HIGH LINE SPEED

THE HALF-YARD INSLEY has speed on the lines and speed on the swing (5 r. p. m.) that gives it high operating speed—three and four passes per minute—on any job.

Another feature—"tireless operation"—means that the operator can keep his Insley at top speed hour after hour and day after day throughout the season, because the Insley is built for easy operation. The Insley cone clutches give flexibility—the clutch cams faced with ball bearings require no effort to thrust—and the operators seat is located to give a good view of the work.

The easier you make the operators job the more work he can do in moving yardage. That's one reason why the Half-Yard Insley "pays."

INSLEY MANUFACTURING COMPANY
Engineers and Manufacturers
INDIANAPOLIS, IND.
Division of National Equipment Corporation

INSLEY

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729

KOEHRING

Let the swivel boom point fairlead save time

Side casting goes faster because of Koehring swivel boom point fairlead—no need for bucket to come to rest at point of boom before dumping! For the same reason—

Sloped bank work means no excessive cable wear when bucket is set down at top of bank and retrieved at an angle from the boom! The swivel boom point fairlead always self-aligns with cable!

"Stepped up" hoisting speed means more bucket trips per day! *Koehring Finger Tip* control means bucket-spotting accuracy and man-saving ease of operation that delivers extra profit yardage!

—and when you take a Koehring far from machine shops, Koehring Heavy Duty construction and easy accessibility fortify you against breakdown, tie-ups and delays!

Know the Koehring!

Write for Dragline Bulletin.

Dragline Capacities

Quickly convertible to shovel, pull shovel or crane. Swiveling boom-point fair-lead, and extra wide and long multiplanes optional.

No. 301—¾ yd. bucket on 40′ boom. Other sizes at proportionate boom lengths. Wisconsin 4 cylinder gasoline engine, 5¼″ x 6½″, 1060 R. P. M.

No. 501—1¼ yd. bucket on 45′ boom. Other sizes at proportionate boom lengths. Wisconsin 4 cylinder gasoline engine, 6″ x 7″, 1075 R. P. M.

No. 601—1½ yd. bucket on 45′ boom. Other sizes at proportionate boom lengths. Wisconsin 6 cylinder gasoline engine, 6″ x 7″, 925 R. P. M.

Division of National Equipment Corporation

KOEHRING COMPANY MILWAUKEE, WISCONSIN

PAVERS, MIXERS—GASOLINE SHOVELS, PULL SHOVELS, CRANES AND DRAGLINES

Sales Offices and Service Warehouses in all principal cities

Foreign Department, Room 579, 50 Church Street, New York City

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An annual capacity of

20,000,000 barrels

. . . with dependability in every barrel

There are plenty of problems to worry the engineer and contractor on any large project. . . . But when the specification is Atlas, Portland Cement is not one of them.

Not a second thought need be given deliveries. The locations of Atlas mills enable one to supplement another when requirements demand. Their combined shipping capacity is 20,000,000 barrels annually. Their storage facilities mean quick and sure delivery for any need.

Not a second thought need be given quality. For thirty-nine years Atlas has consistently exceeded every specified quality requirement. The same dependability that passed 800,000 government tests without a single rejection, on the Panama Canal, is present in every barrel.

Engineers and contractors *depend* on Atlas.

THE ATLAS PORTLAND CEMENT COMPANY, MAIN OFFICES: NEW YORK, ST. LOUIS
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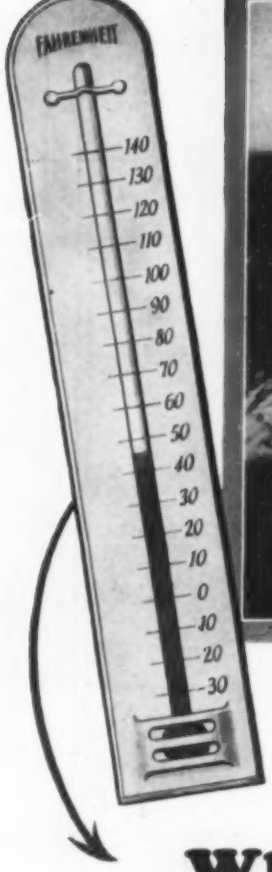
ATLAS
PORTLAND CEMENT



Protecting a pavement placed in late autumn, near Gary, Ind.

When a Cold Snap Threatens,

Use High-Early-Strength Universal Concrete

1. It cuts to 3 days the time during which concrete requires protection against freezing.
2. It develops as great a strength during the *3-day* protection period as ordinary concrete develops in *28 days*.
3. It assures more watertight, more durable and permanently stronger concrete than is ordinarily obtained even in the most favorable weather.

Description of methods for obtaining high-early-strength concrete with the same Universal cement used for regular work, together with a booklet on cold-weather concreting, will be sent on request. In addition to following carefully these methods, it is always desirable that strength tests be made on concrete placed in cold weather. Just use the coupon.

Name

Address

Universal Portland Cement Co.
208 South La Salle Street, Chicago

Without obligation, please send me booklet giving full details for obtaining strong concrete in 3 days with the usual Universal cement. Send also booklet, "Concreting in Cold Weather."

C.M. 11-29

Universal Portland Cement Co.

Subsidiary of United States Steel Corporation

Chicago Pittsburgh Minneapolis Duluth Cleveland Columbus New York

Concrete for Permanence

Construction Methods

A McGraw-Hill Publication—Established 1919

ROBERT K. TOMLIN, *Editor*

VOLUME II | NEW YORK, NOVEMBER, 1929 | NUMBER 11

BLASTING GRANITE BLOCK (*above*) deposited on roadway by rock slide. After clearing away rock, ¾-yd. shovel opens roadway through deep snow slides with special 2¼-yd. dipper (*left*).

MIXED DIET *for Mountain Shovel*

By C. E. RANDELS

Park Engineer, Glacier National Park, Belton, Montana

OPENING the transmountain highway to Logan Pass in Glacier National Park by the middle of June seemed an impossibility, owing to the lateness of the spring and the continued cool weather, but methods introduced by the park authorities disposed of rock and snow slides promptly.

A rock slide of the previous October had taken out 70 ft. of masonry guard rail to a depth of 12 ft. and had left a solid block of granite containing 300 cu.yd. on the newly completed highway. On June 4, a crew of five rock men started work by making a perfect shot at this point. An Osgood Commander ¾-yd. shovel cleared away the rock and then exchanged its ¾-yd. bucket for a specially designed 2¼-yd. dipper preparatory to tackling the snow slides. With this dipper it removed 25,000 yd. of snow in slides up to 40 ft. deep, side casting 1,500 to 2,000 yd. each 8-hour shift. Sluicing with power pumps and shooting with dynamite were other methods used to expedite removal of the snow.

This Month's "News Reel"

©International

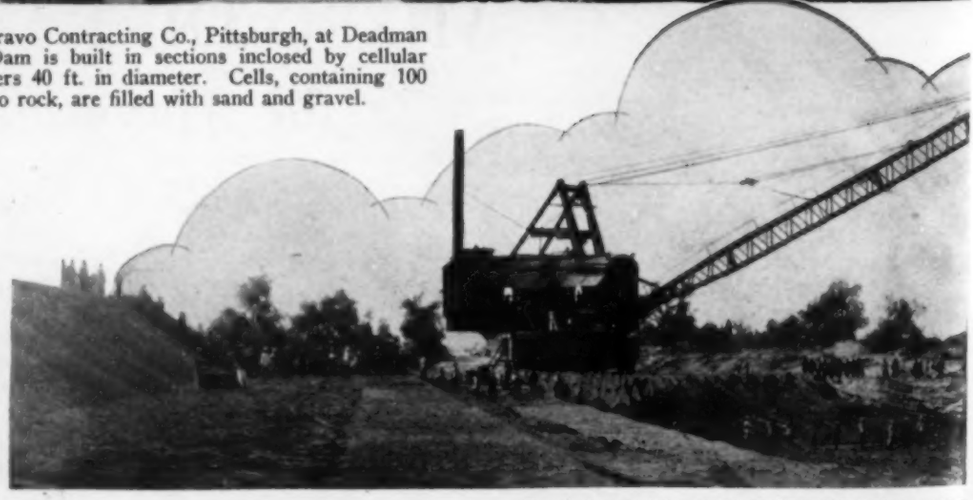
BON VOYAGE! President Hoover greets delegates to World Engineering Congress at Tokyo. Elmer A. Sperry *(right)*, chairman of United States committee; M. Holland (*left*), secretary.

PLATE - CHAIN SUSPENSION BRIDGE at Tokyo, Japan. Links of chains are flat plates instead of eye-bars. Main span, 300 ft.; side spans, 150 ft.; distance c. to c. of chains, 60 ft.

OHIO RIVER DAM is completed by Dravo Contracting Co., Pittsburgh, at Deadman Island, 13.5 miles below Pittsburgh. Dam is built in sections inclosed by cellular cofferdams made up of steel pile cylinders 40 ft. in diameter. Cells, containing 100 Carnegie piles 40 ft. long, driven to rock, are filled with sand and gravel.

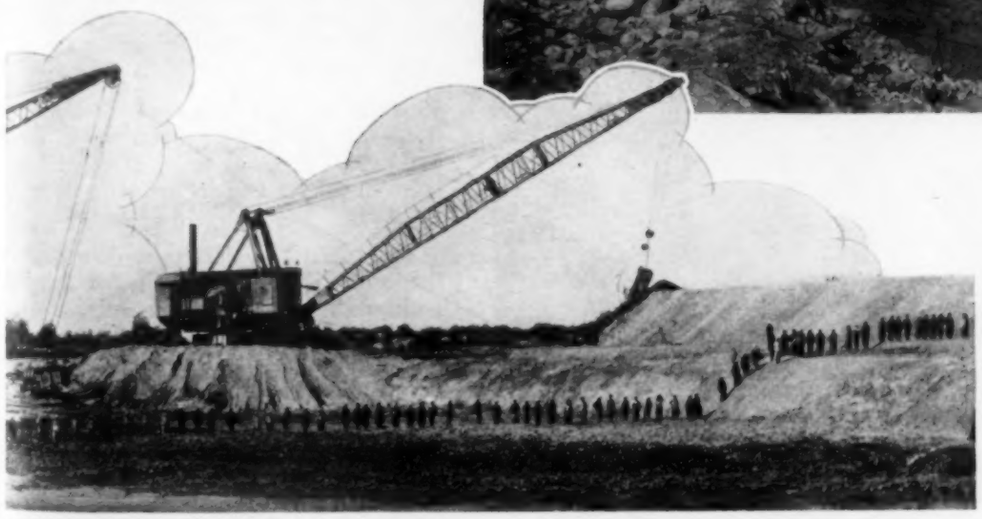
EXCAVATING INDIAN CANAL 200 FT. WIDE *(right)*. Bucyrus and Ruston 6-yd. draglines dig canals of Lloyd Barrage Scheme for total cost of less than 8c. a cubic yard. Bucyrus machine moved 160,000 yd. in one month, working 132 hours a week

Photo from
H. J. AJWANI, Assistant Engineer
Lloyd Barrage and Canals Scheme
Larkana, Sind, India.



©Wide World

SUSPENSION BRIDGE TO SPAN ROYAL GORGE. Towers and construction cables *(above and left)* are erected at projected highway crossing of great chasm near Canyon City, Colo. Structure, claimed to be highest in world, will have main span of 800 ft. and total length of 1,200 ft.



SALT SPRINGS DAM of the Pacific Gas & Electric Co. on the Mokelumne River, Calif., will have toe of derrick-placed rock covered with concrete slab. Dam, 360 ft. high, containing 3,000,000 cu.yd. of rock fill, will be completed in 1931.

TUNNEL *in the Cumberland*

H. E. KLOSS (*right*), resident engineer on the long tunnel for the railroad company, and J. B. BRAY, in charge for the contractor.

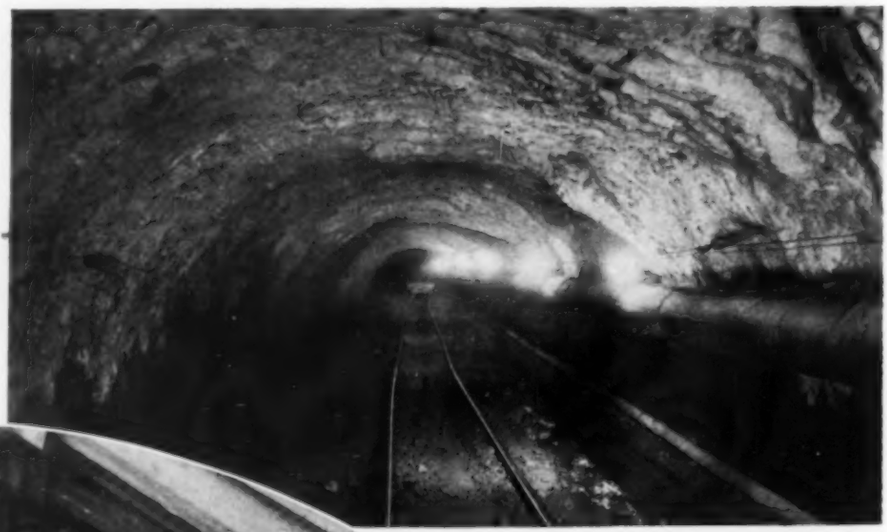
EXCAVATION of more than 2,000,000 cu.yd. of material and driving of about 9,000 ft. of tunnel on 13.6 miles of single-track construction in the mountains between Kentucky and Virginia are being accomplished for the Louisville & Nashville Railroad by the extensive use of plant and equipment.

This line will be a link in the connection between the Louisville & Nashville Railroad and the Clinchfield Railroad, which has been leased by the former railroad and the Atlantic Coast Line. This connection will offer a new direct outlet to the Southeast, and to export, for the vast coal fields of Kentucky. At the same time, it will afford a short line for the movement of merchandise freight between the Middle West and the Southeast.

Location of Route—The country traversed by the line is exceptionally rough and broken. Location, however, is on a 0.5 per cent ruling grade against southbound traffic, with no adverse grade in the opposite direction. This low gradient in such mountainous country accounts for the exceptionally large amount of excavation and the unusual total length of tunnel.

The outstanding construction feature of the project is the driving of a 6,215-ft. tunnel through the main range of the Cumberland Mountains, with one end in Kentucky and the other in Virginia. The concrete-lined section of this tunnel will have a clear width of 16 ft. and a clear height of 24 ft. above top of rail. The extra 2 ft. of height over the standard of the company is to aid ventilation, no shafts for that purpose being provided between portals.

Character of material encountered has made tunnel driving difficult. Rock strata inclined vertically at an angle of 45 deg. cross the line at a horizontal angle of about 89 deg. Condition of the rock varies greatly, most of it requiring heavy timbering. The entire bore will be lined with concrete placed inside the timbering. Total height of the section that has to be driven thus is about 30 ft., and the average width is 21 ft.



FLEXIBLE CLOTH VENTILATING DUCT is used effectively in delivering air to working faces of the tunnel.

TUNNEL SPOIL at Virginia end is loaded into 4-yd. cars and hauled to foot of shaft by mules. At the portal it is shifted into 12-yd. steel dump cars operated in trains.

Tunnel Driving Methods—Work on the tunnel has been conducted from both ends. A top heading the size of the full section down to the springing line of the arch was driven first. After holing through to join the two headings, the bench is being removed from both ends.

This regular procedure had to be modified at the Virginia end on ac-

DRIVING *Mountains*

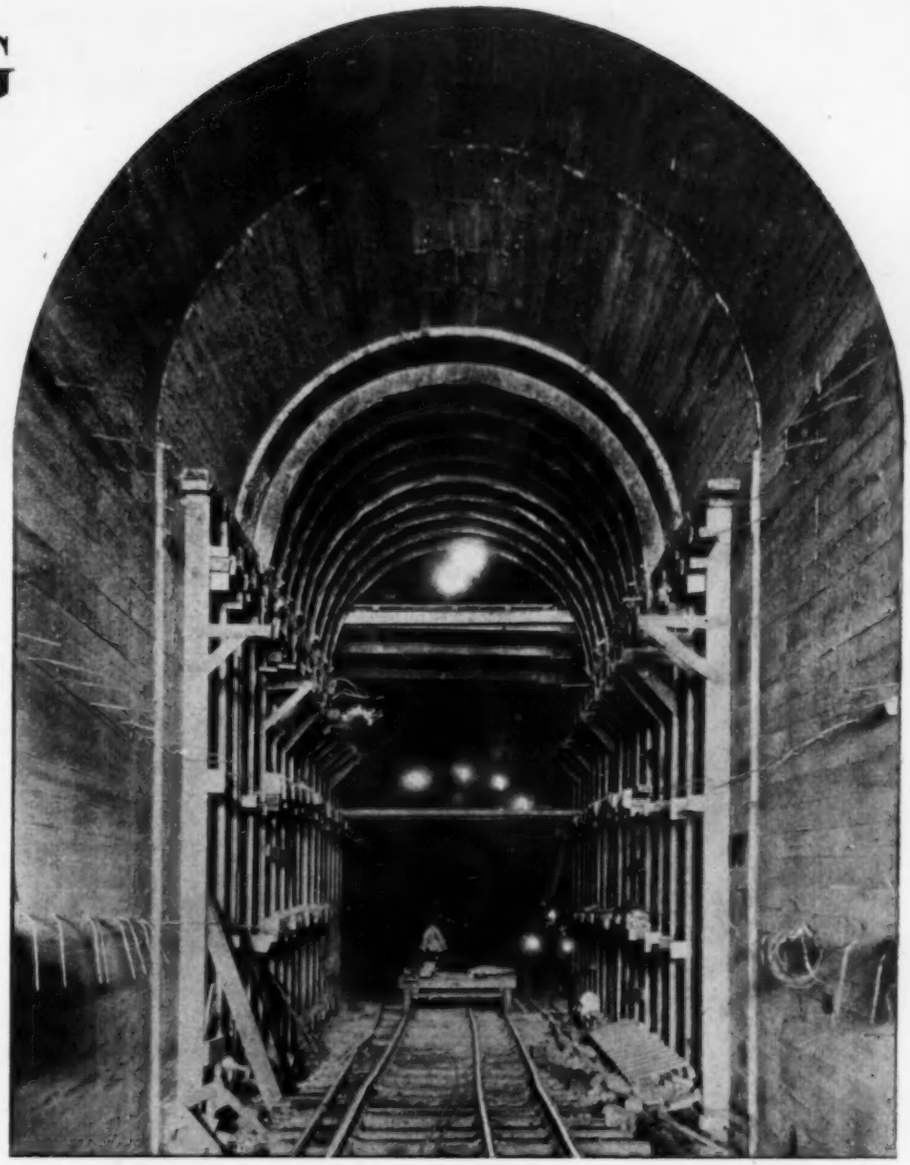
count of soft disintegrated shale met there. To solve the problem introduced by this material a 12x21-ft. shaft, 150 ft. deep, was sunk on the center line of the tunnel, 700 ft. from the portal. The heading was then advanced in both directions from the foot of this shaft. Meantime, the Virginia portal was built of concrete in an open cut, after which the heading was advanced from it toward the shaft.

Top Heading in Loose Shale—For much of the distance from this portal to the shaft it was necessary first to drift wall plates in a 3x5-ft. tunnel on each side. These plates were placed 3 to 5 in. high to allow for settlement in the soft material. The shale was disintegrated so much that practically no dynamite was required in loosening it, Sullivan air-driven pavement breakers being used for this purpose.

With the wall plates in place, the core of the heading was removed with care. Settlement was prevented by the placing of 12x12-in. arch ring timbers solid right behind the excavation. The bench then was taken out as close to the heading as the work could be handled. As fast as the full section was excavated and timbered the permanent concrete lining was placed.

Drilling and Mucking—Standard practice was followed in drilling for the headings, the number of holes and the amount of powder used depending on the character of the material. In each heading there were installed two Sullivan T-3 water hammer drills, operated by compressed air. The loosened material is loaded by a Hoar air-operated mucking shovel into 3-yd. 36-in. gage cars. At the Kentucky end the cars are hauled out with a gasoline locomotive to a fill beyond the portal. At the Virginia end the hauling is done to the foot of the shaft by mules.

At the shaft, spoil from the heading has been wasted on a dump. Tunnel cars are shifted on this dump by a cable on an air-operated single-drum Sullivan hoist, which has handled all the shifting on as much as a 500-ft. haul with a switchback.



COMPLETED SECTION of tunnel near Virginia portal, showing exceptional height. Concrete lining was placed by hand as an emergency measure to hold extremely soft ground.

At the Virginia portal tunnel spoil has to be hauled considerable distances. To facilitate this hauling, the material is shifted from 4-yd. dump cars to 12-yd. steel dump cars operated in trains. This shifting is neatly done on a platform reached by an incline, as is shown in one of the accompanying pictures.

Air for ventilating the headings, provided by a Sturtevant blower at each portal, is delivered to a point near the working face through 20-in. standard Dupont-Ventube. Good conditions are thus maintained with practically no delays on account of fumes. Ample supply of fresh air at all times also makes for greater efficiency of the drill and mucking crews.

Bench Excavation—For the removal of the bench spoil two air-operated ¾-yd. Erie mucking shovels have been installed, one for each end. These shovels have reduced to the minimum the amount of hand labor required.

At the Virginia end two angle-compound Sullivan compressors, each driven by a full Diesel Fairbanks-Morse engine, furnish 2,000 cu.ft. of free air per minute for driving the various tools and equipment on that end of the job. One of these units, supplemented by two portable gasoline compressors, furnishes air at the Kentucky end.

A 125-kw. Fairbanks-Morse Diesel engine driven generator in the power plant at the Virginia end supplies electric energy for lighting the entire job. It also furnishes power to the motors on the fans at both ends.

The employment of Diesel engines for this service has proved very satisfactory. The units have been in use two shifts, six days a week for 12 months, with practically no shutdowns,

except on Sundays and important holidays. Even near the center of a rich coal field the use of crude oil for fuel has been economical. No highly skilled men have been required to get good results, although reliable operators have been found very desirable.

Concrete Plant — Concrete for lining the tunnel and for adjacent structures is mixed in a plant set up on the edge of the approach cut of the Virginia portal. All concrete materials are imported, deliveries being made in standard-gage cars, from which they are dumped through a trestle into bins. From the latter the materials are handled in 4-yd. cars to an Erie aggremeter from which the mixer is fed.

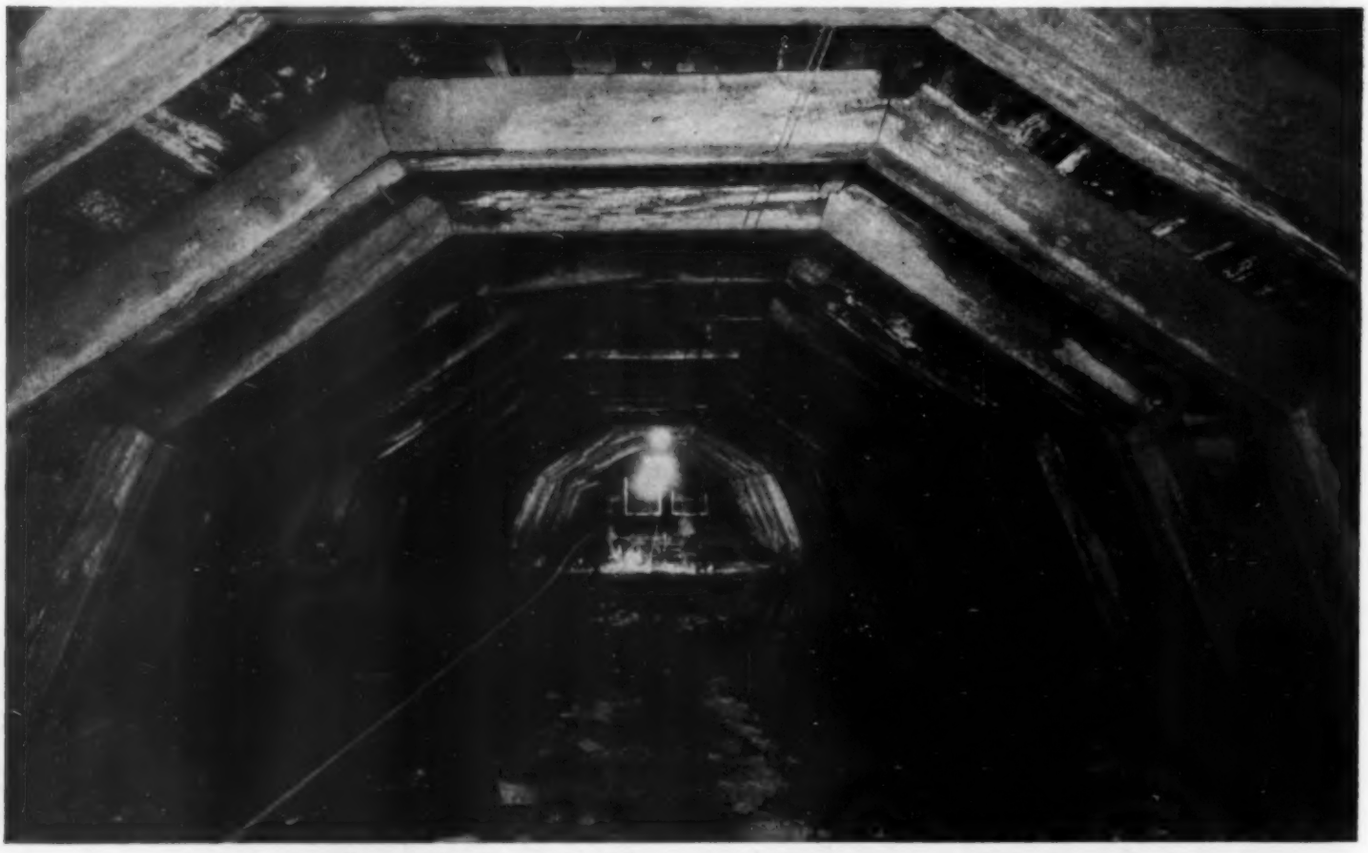
The plant contains a ¾-yd. Smith mixer which discharges into a controllable bottom-dump bucket swung from a four-wheel carriage. This carriage operates up and down a 45-deg. inclined track shored up on the slope of the approach cut to a point over the track in that cut. The carriage with its load is handled on the incline by a small air-operated single-drum Sullivan hoist, that has proved very effective for this service.

AIR-OPERATED MUCKING SHOVEL loads loosened material into 3-yd. 36-in. gage cars which are hauled out with a gasoline locomotive to a fill beyond.

Lining Tunnel — Lining of the tunnel from the Virginia portal to the shaft has been done by hand. Shovelers work on two different levels of platforms on a scaffold car. The bucket delivers concrete from the mixer plant to one or the other of these platforms, and a locomotive then shifts the car into the tunnel, where the concrete is placed in the forms by hand. Plans for a plant for lining the balance of the tunnel are being developed.

Concrete for large underpasses and waterways adjacent to the Virginia portal is delivered from the mixing plant to a hopper car by the bucket on the carriage. The car chutes its load of concrete to place, after being shifted to a point over or near the structure.

The grading work on the project outside of the tunnels is noteworthy only on account of its magnitude. Standard plant and equipment are be-



HEAVY TIMBERING was required during the driving because of the condition of the rock, which was inclined to fall.

CONCRETE PLANT at Virginia portal mixes concrete for tunnel lining and for adjacent structures. The ¾-yd. mixer discharges into a controllable bottom-dump bucket swung from a four-wheel carriage which runs on an inclined trestle crossing in front of portal.

COMBINATION CULVERT AND HIGHWAY UNDERPASS, all on a skew and under a high fill.

NARROW-GAGE INCLINE over which tunnel muck cars are handled to deliver to 12-yd. cars for long haul to dump. The 4-yd. mine cars side dump from platform into 12-yd. cars on track below.

ing used in handling it. One of the principal problems involved has been to get the equipment across the high mountains over roads that were scarcely more than trails and through streams and much deep mud. Shovels on crawler mountings were taken in over these trails without mishap and with little difficulty. Cars, light locomotives, compressors and other plants have been hauled on sleds drawn by 10-ton Caterpillar tractors. Most of the supplies also are taken in by these tractors, which make surprising time over roads that are hardly fit for a wagon. Experience on this job demonstrates to what extent the crawler mounting and the chain tread tractor have revolutionized the placing of plant on an isolated mountain project.

Much of the grading on the line is in rock. Well drills driven by gasoline engines are used to drill the holes for blasting in the rock cuts. All fills are made by dumping from trestles built of native timber.

One of the subcontractors uses mats under his crawler-mounted steam shovels in all except rock bottom cuts. In soft earth, he claims, the mats save much time in maneuvering the shovels.

The railroad company did the grading for 3.61 miles at the north end of the line with its own forces, using heavy railroad-type steam shovels for excavation.

Personnel—W. H. Courtenay is chief engineer and G. R. Smiley is chief engineer of construction of the Louisville & Nashville Railroad. The field operations have been under the supervision of resident engineers, H. E. Kloss, C. A. Smith and J. B. Cochran, Mr. Kloss being in charge of the long tunnel. The general contractors on the project are W. W. Boxley & Co., of Roanoke, Va., for whom J. B. Bray is in charge at the long tunnel and adjacent work. Thse men expect the line to be completed and ready for operation by June, 1930.

BOTTOM-DUMP BUCKET hung from carriage on inclined trestle delivers concrete to platform of two-level scaffold used in lining portion of tunnel by hand.

Protective Measures Make Possible WINTER CONSTRUCTION *of Concrete Arch Bridge*

COLD WEATHER CONCRETING of arch ribs proceeds under cover of canvas housing heated by salamanders and steam. Light overhead cableway, with towers mounted on pier shafts, delivers concrete to platform at crown of arch, whence it is distributed by light chutes under canvas.

CANVAS inclosures, salamanders, and live steam enabled the Concrete Steel Bridge Co., of Clarksburg, W. Va., to carry on the pouring of arch ribs and deck of a highway bridge across the Susquehanna River at Hyner, Pa. during periods of last winter when the temperature dropped to 8 deg. below zero. The bridge was built for the Pennsylvania Department of Highways.

Method of Construction—Seven arch spans, five of 160 ft. and two of 85 ft., comprise the main portion of a concrete structure 1,127 ft. long. Blaw-Knox steel truss centering for the arches was erected on shore and was moved ahead to the river spans by trucks on a trestle alongside the bridge. A light cableway, towers of which were erected on completed pier shafts, delivered concrete for the ribs to platforms erected above the crowns.

By making a tight canvas inclosure around the work and using salamanders and steam lines to generate heat, it was possible to raise the inside temperature to the proper point. To reduce the admission of cold air to a minimum, the contractor distributed concrete for both arches and deck by chutes. The use of chutes eliminated any opening and closing of flaps which would have been necessary to admit buckets or cars. Inclosures were made large enough to accomodate workmen of the placing crew.

CANVAS COVERING is placed over frame of 2x6-in. timbers erected on steel centers and is made fast by battens and tying at bottom.

Protecting Arch Rib—A full arch rib, with steel centering, was inclosed at one time. The form for the arch rib was made ready for concrete, and a skeleton frame of 2x6's then was erected over the forms and steel centering. A canvas covering was placed around the skeleton and was made fast by 1x6-in. battens and by tying at the bottom, as one of the photographs shows. Ribs were poured in four sections.

Before starting a pour it was necessary to have the temperature under canvas above 50 deg. F., and the temperature had to be kept above 50 deg. for 5 days after the concrete had been placed. Salamanders hung in the steel centering and live steam escaping from ¼-in. pet-cocks of a steam line under the canvas raised the temperature to the desired point. The salamanders kept up the temperature during the pour, when the steam had to be cut down to permit workmen to see while placing concrete.

Steam pipes under the sand and stone piles, a boiler for the water, and an Aeroil flame burner on the

STEEL TRUSS CENTERING (*above*) is used for arches on land and is moved ahead to river spans by trucks on trestle.

DECK SECTION and open spandrel (*left*) are inclosed in canvas for purpose of making a pour.

Ransome 28-S mixer heated the materials. Temperature of the concrete when placed ranged from 65 to 75 deg. F.

Concreting Deck Section—In pouring deck sections, the contractor inclosed each portion in a canvas housing supported on a frame of 2x6-in. timbers made high enough to allow workmen to stand erect. Bottom dump cars running on a trestle above the canvas delivered concrete to light chute sections used for distribution within the inclosure. Live steam escaping from ¼-in. pet-cocks held the temperature above 50 deg. during the pour and for 5 days thereafter. Condensation of steam kept the concrete moist while curing.

Even at 8 deg. below zero, temperature under canvas surrounding an arch rib was kept around 60 deg., with the temperature of the green concrete itself 20 deg. higher. As indicated by a graph of the curing temperatures for a deck section, the concrete temperatures followed closely those of the surrounding air.

H. Paul Rule, who, as superintendent, had charge of all these operations, supplied the accompanying photographs and data to *Construction Methods*.

CONCRETE FOR DECK is delivered by bottom dump cars running on trestle above the canvas inclosure. The housing is high enough to permit workmen placing concrete to stand erect.

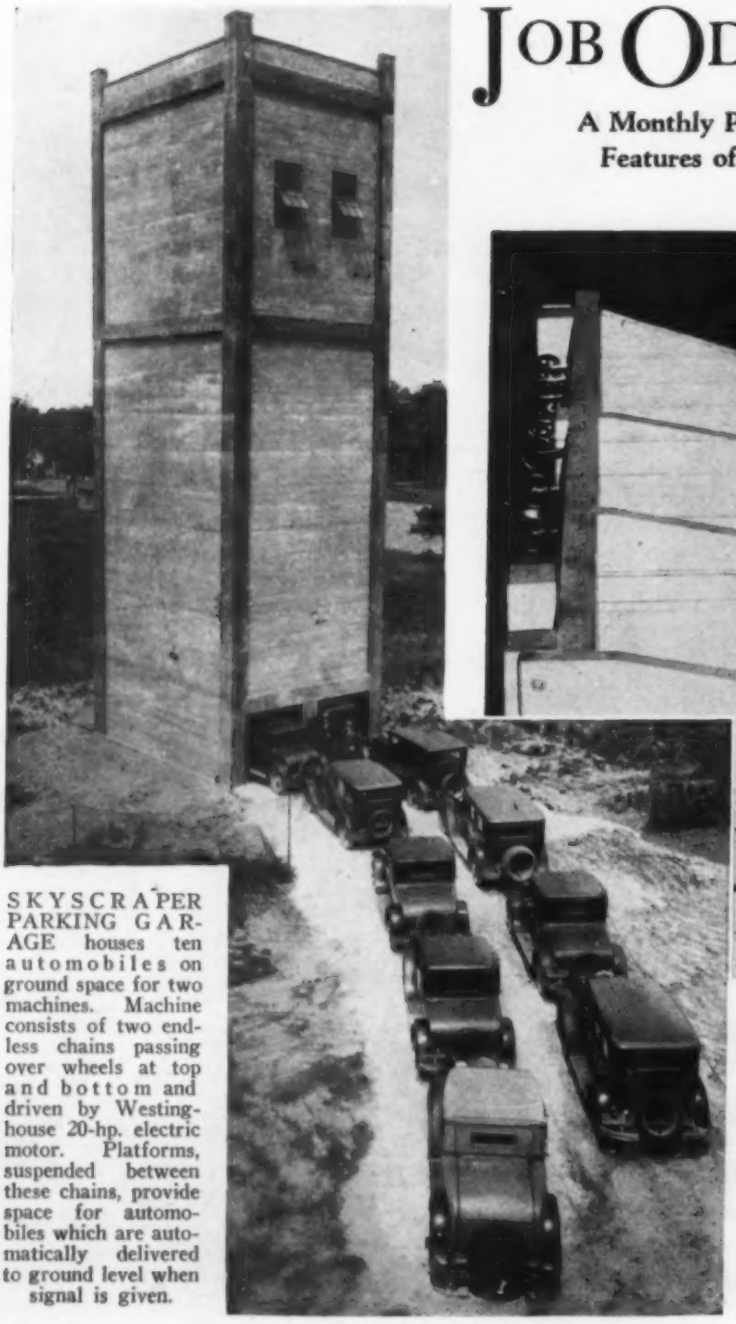
SOLO WRECKING JOB. Power shovel demolishes one-story brick building, loads trucks with debris and handles timber roof trusses for removal from site.

©P.&A.

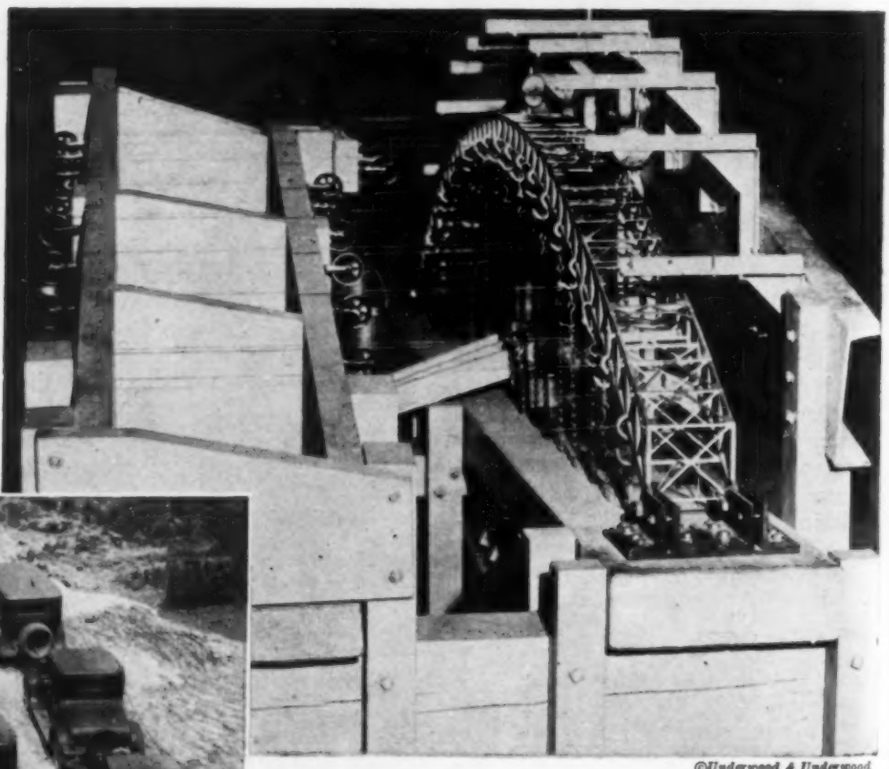
"FANNED OUT" FOR SUNSHADE. Telephone cable containing 3,600 wires, with a peak capacity of 180,000 words a minute, will be used by the Pacific Telephone & Telegraph Co. to hook up San Francisco stock exchange offices.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction



SKYSCRAPER PARKING GARAGE houses ten automobiles on ground space for two machines. Machine consists of two endless chains passing over wheels at top and bottom and driven by Westinghouse 20-hp. electric motor. Platforms, suspended between these chains, provide space for automobiles which are automatically delivered to ground level when signal is given.



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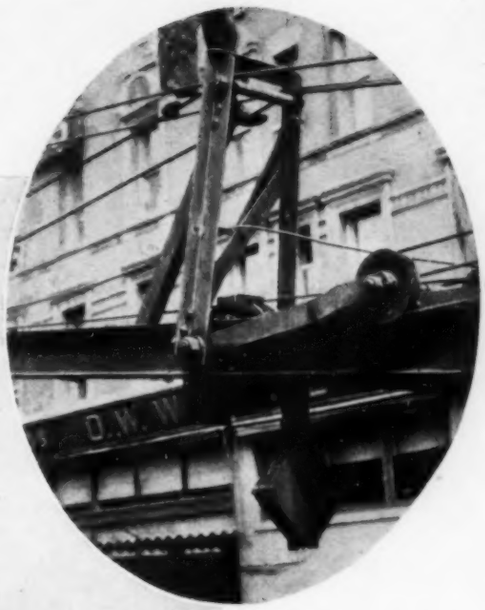
SAFETY FOR PASSENGERS. Bronze model of Kill van Kull Bridge between New Jersey and Staten Island, N. Y., set in wooden framework for testing load capacities and wind deflections. On the basis of these tests work is proceeding on the bridge, which will be 8,750 ft. long, including the approaches, and contain 34,800,000 lb. of steel. The main arch contractors are H. P. Converse & Co., Boston, and American Bridge Co.

ADJUSTABLE JIB
Increases Utility of Crane



HORSE at the top of the main boom carries tie-back cables from the two parts of the adjustable jib.

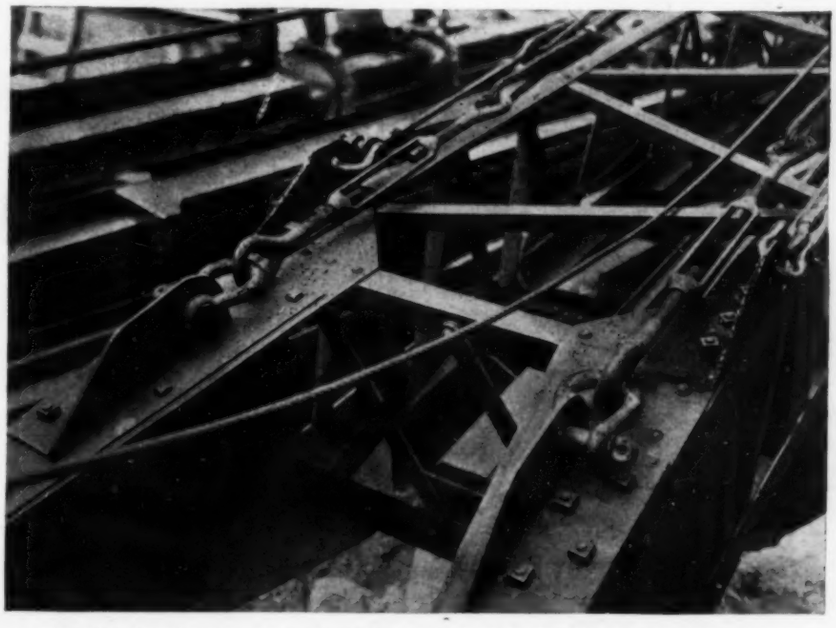
ADJUSTABLE JIB consists of two parts: a 20-ft. rigid boom extension and a 17-ft. tip which swivels vertically. Both parts of the composite extension are trussed. The tip handles 4,500-lb. loads and erects all steel for six-story structures.

A HINGED jib increasing its reach and overhead radius enabled a Moore 15-ton crane to set all the steel for a six-story building in New York City. The two parts of the composite jib increased the length of the 45-ft. boom to 80 ft., and the adjustable tip gave the crane a horizontal reach of 17 ft. for any position of the boom.

The hinged jib really is a combination of two jibs, the first being a rigid extension of the main boom and the second a swivel tip seated at the top of the rigid extension. The rigid extension, consisting of two 10-in. channels 30 ft. long riveted to the top of the boom, increases the length to 65 ft. A truss to strengthen the lengthened boom is formed, as shown in the photograph, by passing tie-backs ($\frac{3}{4}$-in. cables) over a horse and anchoring them at the bottom of the boom.

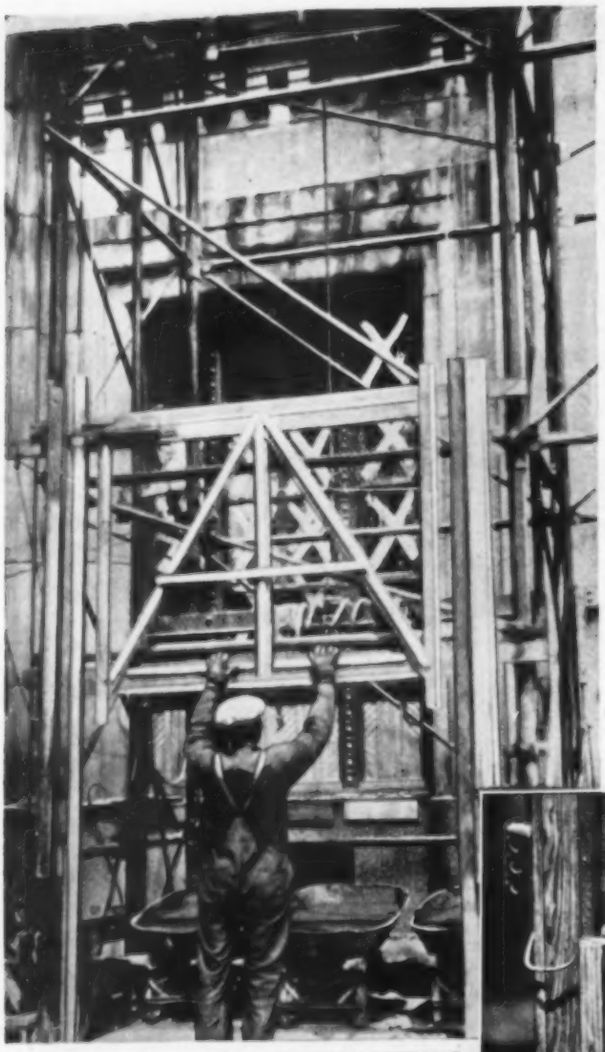
Two $\frac{3}{8}$-in. plates were riveted to the top of the lengthened boom and were fitted with a $1\frac{1}{2}$-in. pin to form a boom seat on which the adjustable 17-ft. tip could swivel vertically. This tip is built of two 8-in. channels with $\frac{1}{4}$-in. plates 8 in. wide as tie bracing. It is trussed in the same way as the rigid boom extension; but, in the case of the tip, the horse was erected leaning forward at an angle of 30 deg. with the boom in order that the 17-ft. jib might be dropped to an angle of 90 deg. with the boom. Turnbuckles at the bottom of the tie-backs provide for adjustment in the length of the cables when the jib is raised or lowered. The top extension handled loads of 4,500 lb. on the job.

Thomas Foley, operator of the crane, designed and built the adjustable jib for Kues Brothers, steel contractors of New York City, who own the machine.



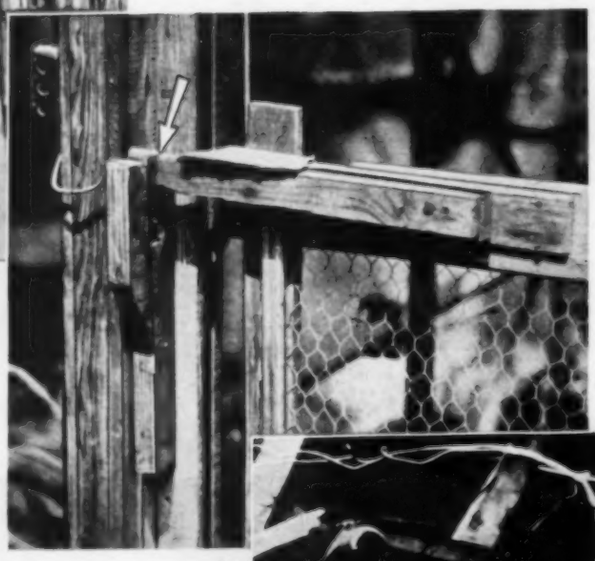
TURNBUCKLES provide for adjustment in length of tie-back cables from 17-ft. hinged tip.

SAFETY *in Gates for Hoistways*

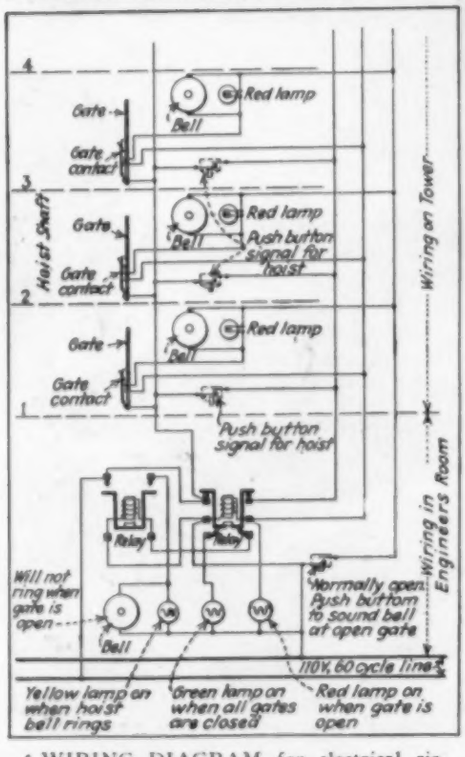


1 VERTICALLY SLIDING COUNTERWEIGHTED GATE, equipped with contact to make and break electrical circuit which signals hoist operator when all gates are closed, is used by Bryant & Detwiler on an outside hoist tower.

REDUCTION of hoist accidents from 41 per cent of all its lost time accidents in 1920 to 15 per cent in 1928 has been effected by the General Builders Association of Detroit through a campaign to develop safety gates for hoistways. These percentages are based on the severity rates for the two years. In the same period, the Association reduced the severity rate

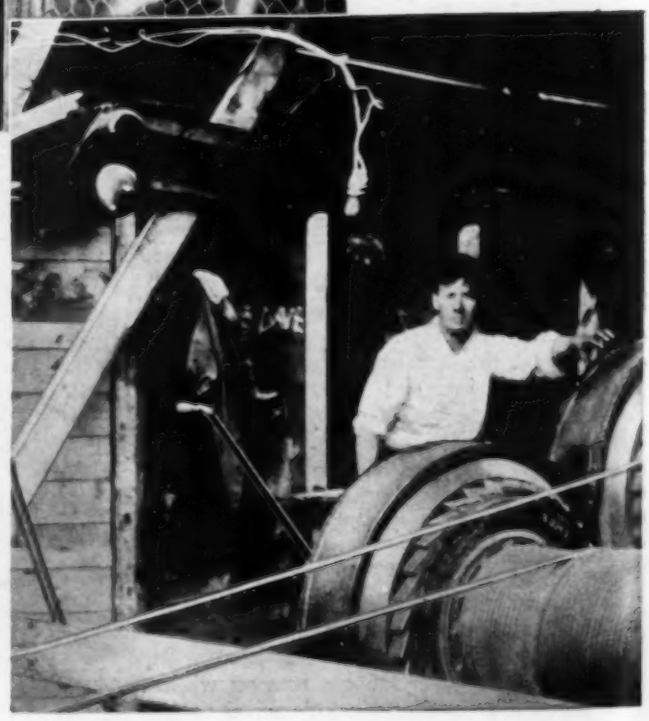


2 ELECTRICAL CIRCUIT COMPLETED by contact when gate is closed.



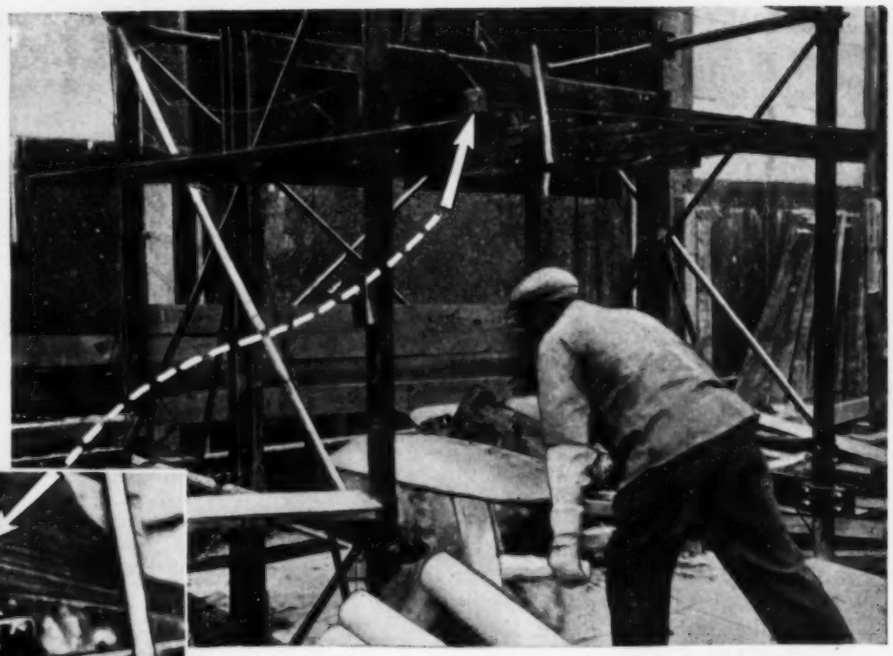
4 WIRING DIAGRAM for electrical circuit on inside hoist. When gate is unintentionally left open at any floor, hoist operator, before moving cage, presses button which, by bell and light, warns workmen on that floor to close gate.

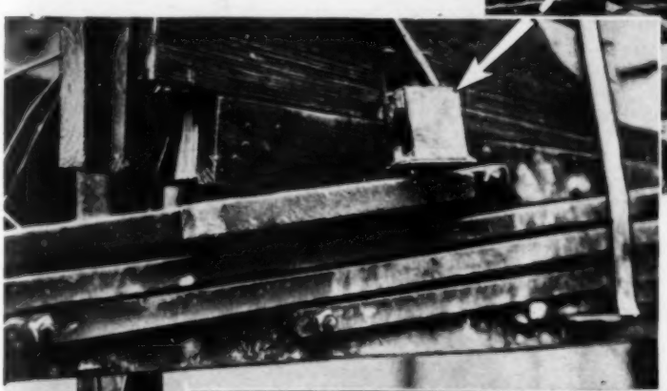
3 SIGNAL LAMP warns hoist operator as to whether all gates are closed. In installations for outside hoists on buildings of moderate height, a simple electrical circuit with one lamp suffices.

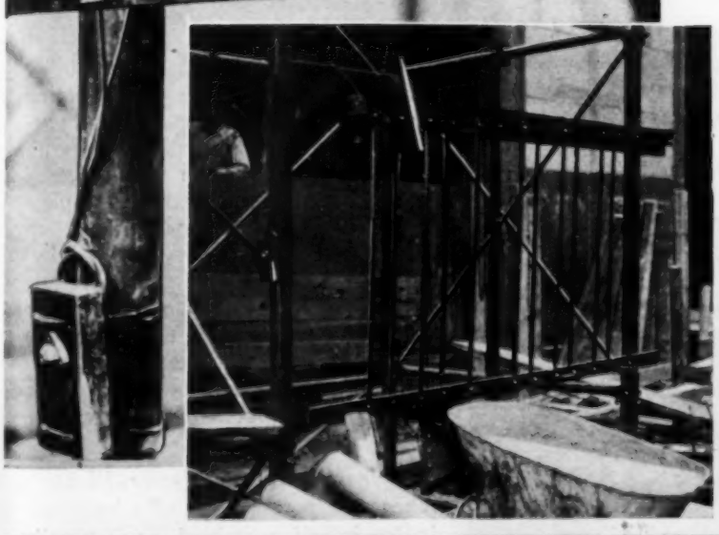


for all accidents sufficiently to lower accident costs 50 per cent.

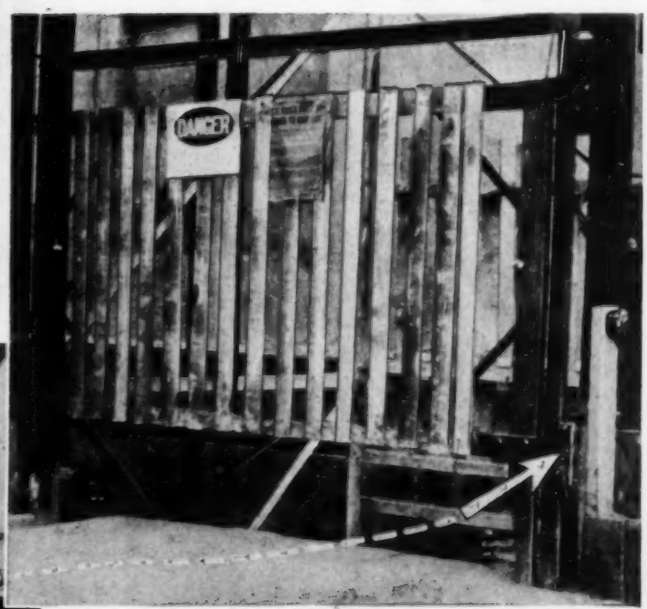
Cash prizes and safety meetings for all superintendents and foremen stimulated these men to design gates eliminating hazards revealed by accidents. Each member firm adapts the fundamental designs to its own needs. Gates under or over which a workman cannot thrust a head or arm and an electric circuit which prevents the hoist operator from moving the platform when any gate is open are the governing features of all installations. The circuit illustrated is practically foolproof.

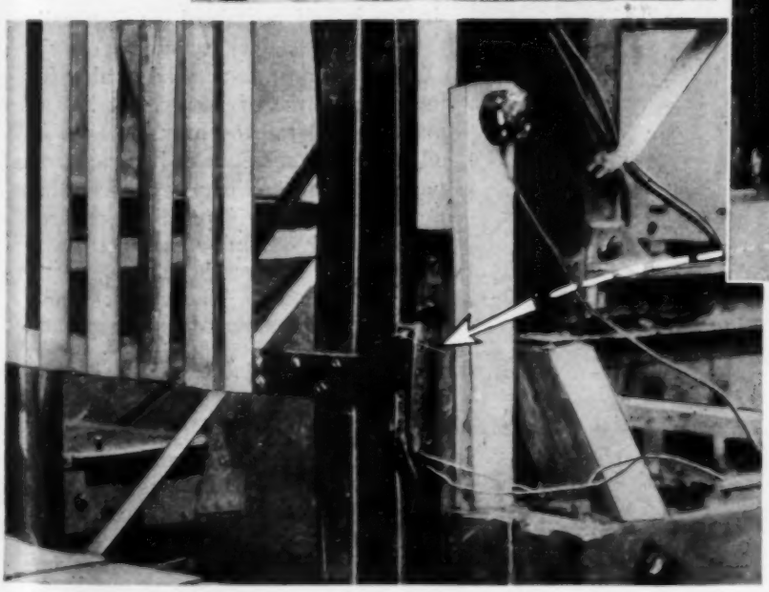






5 FOLDING GATE, made up of steel straps which swivel vertically, is held in open position by hook. Block on steel strap operates push button contact (indicated by arrow) when gate is open, completing circuit and causing red lamp to burn in hoist house. H. G. Christian & Burke Co., contractor on this building, installed a separate circuit to operate the bell signal in the hoist house. This gate (here employed on an outside tower hoist) is one of the types which can be used on an inside hoistway, where low ceiling height requires some kind of folding gate. The lower left photograph shows the gate in closed position.





6 COUNTERWEIGHTED GATE with slide contact (indicated by arrow) for completing electrical circuit is used by the W. E. Wood Co. on an outside hoist. A push-button to operate the bell signal in the operator's cabin is placed on each floor.

These two photos from
RALPH A. MacMULLAN, Secretary
General Builders Association of Detroit

ELECTRIC DRIVE

By C. T. PEARCE

Marine Engineer,
Westinghouse Electric & Manufacturing Co.,
East Pittsburgh, Pa.

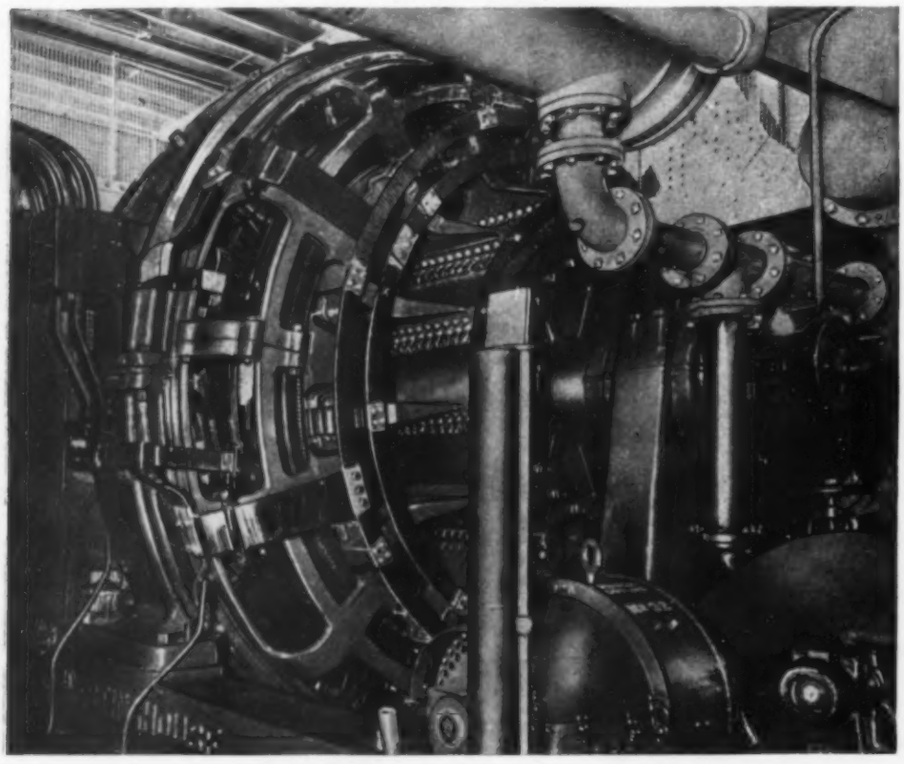
HYDRAULIC DREDGE, "Clackamas," operated by pump. Discharge line is 30-in. pipe. Four main Diesel-

A DREDGE is a floating excavator utilized for the removal of subaqueous material. Broadly speaking, dredges may be classified under the general headings of bucket dredges or hydraulic dredges, depending upon the method employed for excavation of material. Obviously, the former type makes use of some form of bucket or buckets, whereas the latter type pumps the dredged material, mixed with the proper percentage of water, directly into hoppers or impounding basins. Bucket-type dredges may again be subdivided into dipper, clamshell, and ladder dredges, the first mentioned being the floating counterpart of the ordinary power shovel which operates on land.

The hydraulic or pipe-line dredge is manifestly the most economical unit for the excavation and transportation of silt, gravel, and clay where such deposits may be broken down readily by mechanical means and deposited within a reasonable distance of the scene of dredging. It is the only type which takes full advantage of the presence of a liquid medium in removing and disposing of the dredged material. This type of dredge is ideal for making fills in building up or extending waterfronts.

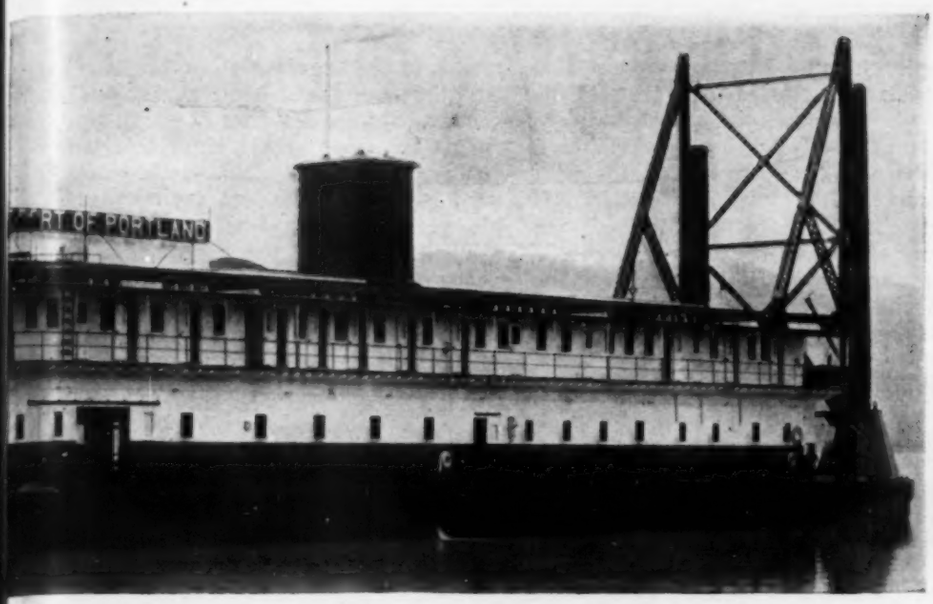
Uses of Bucket Dredges—Clamshell and dipper dredges, served by barges, are used where the material is too hard to permit the use of a hydraulic dredge or where there is no nearby space available for fill. The ladder-type dredge, utilizing an endless chain of buckets for digging, performs very advantageously where it is desired to conserve the dredged material as in mining low grade ore deposits or obtaining sand and gravel for construction purposes. The material is picked up with a minimum of agitation and delivered to the screen in a practically continuous stream with almost no loss.

Due to the popularity of the hydraulic and ladder dredges, as well as the fact that they lend themselves most readily to electrification, this discussion will be confined to the use of electricity on these two types of dredges. Hydraulic or pipe-line dredges will be discussed first.



PUMP MOTOR of "Clackamas" is a 2,700-hp., 250/360-r.p.m., d.c. unit.

Hydraulic Dredge Power Plants—Where the power plant of a hydraulic dredge is self contained, as is usually the case, the fuel economy of the Diesel engine fits it very admirably for use as a source of power. It has an average fuel rate of around .4 lb. of oil per brake horsepower-hour as compared to approximately twice that figure for a corresponding oil-fired reciprocating steam engine. If it is attempted to connect the engine directly to the main pump, however, it results in a very inflexible arrangement and one which is very apt, in the larger sizes at least, to give trouble from torsional vibration. To maintain the proper trim, it is usually necessary to locate the dredge pump and its engine some distance apart, giving a system composed of the engine crankshaft, connecting shaft, and pump runner, and one from which it is almost im-



Port of Portland, has 2,700-hp. d.c. motor to drive main electric sets supply power to motors operating all motions.

RAISES EFFICIENCY *of Dredge Operation*

possible to eliminate critical speeds in the speed range over which dredge pumps are required to operate. If the engine is geared to the pump, the trouble is still further aggravated. When the engines are used to drive generators, the moment of inertia of the rotating members may be quite readily and accurately predetermined from calculation and the engines operated at a constant speed which is well removed from any critical.

Because of its greater flexibility, d.c. equipment is somewhat better suited for use on hydraulic dredges than a.c. equipment. The preferable arrangement is to have two or more relatively high speed d.c. engine-generator sets, connected in series or parallel, to feed the main pump motor which usually absorbs about 75 per cent of the total generated power. With this plurality of generating units, operation can be continued at reduced output when one of the engines becomes disabled. In fact, the engine repairs can be carried out while pumping through short lengths of line when the same pipe-line velocity may be maintained at reduced power by lowering the pump speed.

The substitution of a number of light, relatively high speed sets for one large low speed unit usually results in a reduction in total weight and the equipment may be mounted to better advantage. Not only are foundations lighter but, due to the distribution of weight, a better trim is obtainable. One of the photographs shows two of the engines of the dredge, "Clackamas." These engines operate two of the main generators. In this installation, there are a total of four main engine-generator sets, delivering an aggregate of 2,300 kw. to a constant voltage bus.

Arrangement of Generators—With the generators operating in parallel to feed a common bus, the power for driving all auxiliaries may be taken from the same bus, whereas, with a series system, it is necessary to provide a separate constant voltage auxiliary bus fed from an additional generator. The parallel scheme has the further advantage that full interchange of power may be obtained between the main pump motor and auxiliaries. The power plant is worked to full capacity at all times and the power is divided between the auxiliaries and main pump in such a way as to obtain maximum output from the dredge. This can be obtained with no other type of drive. For reduced pipe-line lengths and power requirements, however, it is necessary, with the parallel system, to provide a larger pump motor with greater field capacity in order to obtain reduced speed whereas, with the series arrangement, the applied voltage would be reduced and the motor field would be weakened rather than strengthened. Generally speaking, the parallel system is the more satisfactory and the one more often used.

Reducing Pump Speeds—Aside from all considerations of reduced generating capacity, it becomes necessary to reduce the pump speed for shorter lengths of pipe line in order to

PILOT-HOUSE CONTROLS of "Clackamas" permit one-man control of all equipment.

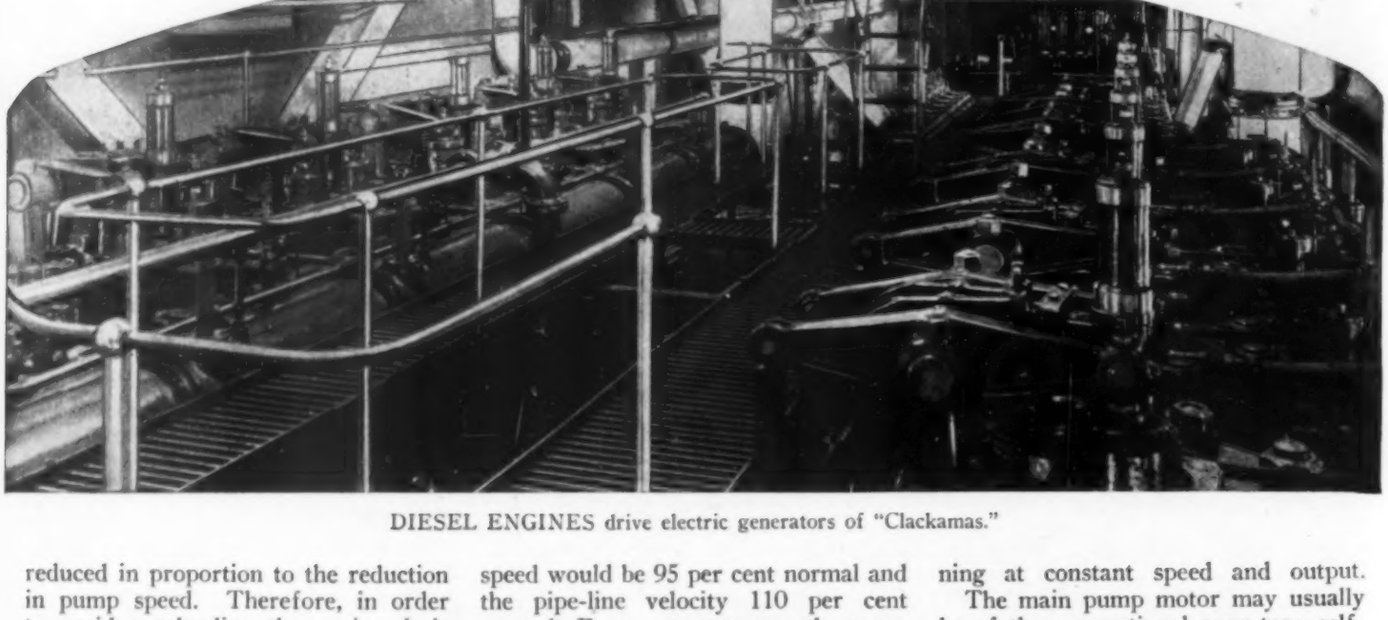
avoid overloading the power plant even though it all remains in operation. Since the pipe-line velocity will be somewhat increased under this condition, however, the pump speed will not have to be reduced nearly so much as when the horsepower is reduced in proportion to the reduction in head with a constant pipe-line velocity. For a direct connected engine, delivering constant torque, the engine rating is reduced in proportion to the reduction in pump speed. Therefore, in order to avoid overloading the engine, it is necessary to reduce the pump speed by a greater amount than where constant horsepower is available as with Diesel-electric drive, even though this reduction will still not be as great as with constant pipe-line velocity. The energy required to deliver a unit of solid material over a unit length of pipe line is a minimum when the pipe line velocity is just sufficient to keep the solid material in suspension. This follows from the fact that the friction head theoretically increases as the square of the pipe-line velocity and the power required on the pump is proportional to the product of velocity times head.

To give some idea of actual values of speed reduction required for different conditions of operation, consider an example where the length of the pipe line is decreased to 75 per cent of its former value. Based on friction constituting the total head, which is a sufficiently close assumption for most instances, the pump speed would theoretically be reduced to 86.5 per cent normal and the horsepower to 75 per cent normal if the same pipe-line velocity were maintained. If the horsepower were kept constant, the speed would be 95 per cent normal and the pipe-line velocity 110 per cent normal. For constant torque, the pump speed and horsepower would be 93 per cent normal and the velocity 107 per cent normal. If it were attempted to keep the same pump speed, the horsepower and velocity would be increased to 116 per cent normal.

Control of Pump Speed—Since direct connected engines do not very readily lend themselves to speed control, the pump speed is oftentimes held constant and the diameter of the pump runner changed to achieve the required change in pressure. This method not only is troublesome and tedious but also results in a lower pump efficiency. With a d.c. motor, speed reduction is very readily obtained, with no loss in power, by means of field strengthening, the engines in the meanwhile running at constant speed and output.

The main pump motor may usually be of the conventional open-type self-ventilated design operating at any desired voltage. Special insulation is used for marine service and drip covers are often provided to protect the motor from the condensate which forms on the deck above. The amount of speed reduction required will, of course, depend upon the intended variations in length of line but 30 per cent below maximum will be found sufficient in most cases. This is obtained by field strengthening, resulting in a motor which can deliver full horsepower over the speed range. A photograph shows the 2,700-hp., 250/360-r.p.m., main pump motor installed on the dredge, "Clackamas."

Regulating Speed of Cutter — For breaking up the material and mixing it with the proper percentage



DIESEL ENGINES drive electric generators of "Clackamas."

TABLE I—AVERAGE OPERATING AND MAINTENANCE COSTS OF THE PORT OF PORTLAND'S 30-INCH HYDRAULIC PIPELINE DREDGES, "TUALATIN" AND "CLACKAMAS"

	Steam Dredge "Tualatin" 810 Operating Days		Dredge "Clackamas" 623 Operating Days	
Performance:				
Rated pumps, hp.	2,000		2 700	
Cubic yards per operating day	10,980		19,720	
Average length of pipe line	3,224		5,126	
Average lift of discharge	25		25	
Operation:	Per Day	Per Cu Yd.	Per Day	Per Cu.Yd.
Labor (operating)	$181.58	$0.01654	$187.73	$0.00952
Fuel and water	287.34	.02617	104.09	.00532
Engineer department supplies	6.25	.00057	40.90	.00207
Deck and miscellaneous supplies	6.09	.00055	9.17	.00046
Auxiliary operation	37.97	.00346	37.76	.00191
Subsistence	40.95	.00373	38.98	.00198
Insurance	33.08	.00302	39.66	.00201
Sub-total (operation)	$593.26	$0.05403	$458.29	$0.02327
Maintenance:				
Cutting machinery	$11.11	$0.00101	$8.79	$0.00045
Hull pipe and fittings	15.33	.00139	7.63	.00039
Ground tackle	7.90	.00072	15.69	.00079
Dredging pump	35.02	.00319	75.58	.00383
Power plant and auxiliaries	48.10	.00438	72.04	.00365
Miscellaneous dredging plant	18.69	.00170	15.40	.00078
Hull and house	10.89	.00099	12.89	.00065
Miscellaneous supplies and labor	10.38	.00095	11.60	.00059
Insurance	3.54	.00032	2.13	.00011
Sub-total (maintenance)	$160.96	$0.01465	$221.75	$0.01124
Total operation and maintenance	754.22	.06868	680.04	.03451
Booster operation	.....	.00594	.....	.....
Total all items	.....	$0.07462	.....	$0.03451

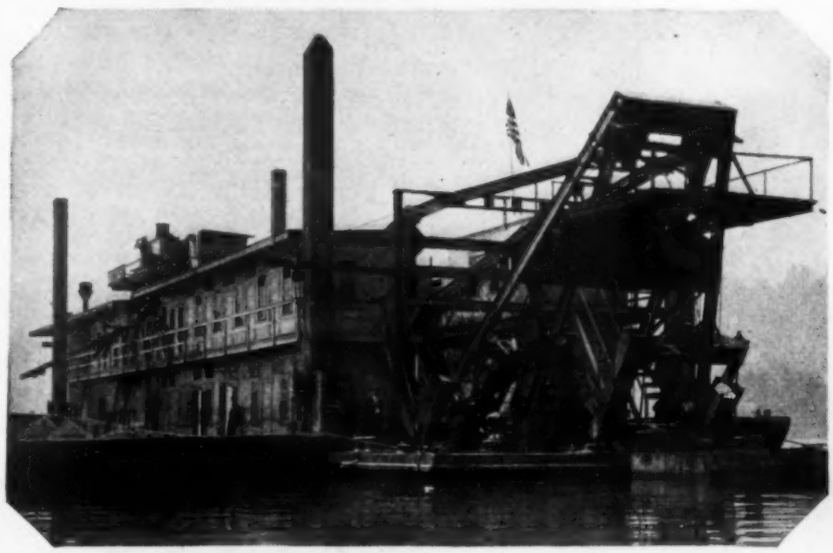
of water for pumping, a revolving cutter or agitator is ordinarily used with hydraulic type dredges. Due to variations in nature and texture of material, as well as changes in length of line, speed control in connection with this motion is essential in order to deliver the proper amount of solid material to the pump at all times. For the usual range of materials, 50 per cent speed reduction on the cutter motion is sufficient, and, with d.c. motor drive, this usually is best obtained by field control. Where a greater speed range than this is required, variable voltage control from a separate generator is often preferable, since this permits the use of a smaller motor, although it may mean an additional motor-generator set. Obviously, it would be very difficult to obtain this speed control satisfactorily with any form of direct drive and, for this reason, the cutter motion oftentimes is electrically driven even where direct engine drive is utilized for the main pump. In order to provide a simpler mechanical arrangement, the cutter motor is quite frequently mounted directly on the ladder near the base. Since the ladder swings through a considerable arc, the motor for this arrangement must be equipped with thrust bearings and is usually totally enclosed and force ventilated for operation in an unsheltered location.

In most instances, one motor is utilized to drive both swing motions, both spud hoists, and the ladder hoist, through a combination five-drum winch with necessary clutches. This makes a very feasible arrangement since there is no occasion to have more than one of these motions in operation at a time. In order to obtain the wide variation necessary in swinging speed, the motor must be arranged for operation over a considerable speed range. For this reason variable voltage control from a separate generator is ordinarily used for this motor. This arrangement provides a large number of economical running points between zero and full speed, something which is unobtainable with any other form of drive. As in the case of the cutter, the swing motion is quite frequently driven by an electric motor even where direct engine drive is utilized for the main pump.

TABLE II—ONE YEAR DREDGING RECORD OF "TUALATIN" AND "CLACKAMAS"

	Steam Dredge "Tualatin"	"Clackamas"
Cu.yd. dredged	2,818,900	6,277,135
Net terminal lift, ft.	25.6	28.9
Pipe line length, ft.	3,973	4,808
Transport units	131,024	380,385
Total pumping hours	5,405	5,932
Total cost of operation	$221,784.43	$206,799.00
Cost per cu.yd.	$0.08	$0.03
Cost per trs. unit	$1.69	$0.54
Cost per pump hp.-year	$110.89	$76.00

Centralized Operating Control—Aside from its superior flexibility, the electric dredge has no equal for ease and simplicity of operation. The controls for all motors may be located directly in the pilot house or lever room, placing complete control of all equipment at the very elbow of the operator. The main switchboard is usually mounted in the engine room on a flat above the generators. It carries generator overload protection and switches for completion of the required circuit set-ups. In addition, meters are included to give an indication of the operating conditions of all units at a glance. This enables the engineer to load all engines equally and locate sources of trouble such as undue friction, etc., before they can do any damage, resulting in a decreased maintenance cost. One of the photographs shows the pilot house controls of the dredge, "Clackamas."



SAND AND GRAVEL DREDGE, "Elizabeth Pfeil," operated by Iron City Sand & Gravel Co., has a main power plant consisting of a 300-hp. Diesel engine driving a 270-kva. a.c. generator. Main digging chain comprises 87 buckets of 8-cu.ft. capacity each.

Comparative Records—Tables I and II are extracted from information published by J. H. Polhemus, general manager of the Port of Portland, and give the results of a very careful study which was conducted on operating costs of two 30-in. hydraulic dredges. On the steam dredge, "Tualatin," the dredge pump was driven by twin 1,000-hp. turbines, giving a total of 2,000 hp., and on the "Clackamas," by a 2,700-hp. d.c. motor. These dredges were both operated by the Port of Portland and performed an identical class of work except that the higher powered Diesel-electric dredge was used for pumping through longer pipe lines. In Table I, the costs per cubic yard for the dredge, "Clackamas," are, therefore, based on delivering the material through a longer pipe line. In order to designate a unit for use as a basis of comparison, the term transport unit is used in Table II. A transport unit is 1,000 cu.yd. of material pumped through 100 ft. of pipe line, 1 ft. of net terminal lift being considered equivalent to 50 ft. of 30-in. pipe line. By transposing all dredge output to transport units, the variation in pumping head between short and long pipe-line dredging is equalized for purposes of comparing costs. Fuel costs for both dredges are based on fuel oil at $1.30 per barrel of 42 gal. The costs given do not include shore work, overhead, depreciation, or interest charges, and are only for comparative purposes between dredges.

Ladder Type Dredges—The ladder type dredge, when utilized within a small area, justifies the erection of a pole line to obtain shore power. In this case, all operations are usually driven by a.c. wound rotor induction motors, the additional advantage of d.c. drive not usually justifying the extra cost of a motor-generator set.

Sand and gravel dredges must usually carry their own power plants, which most often are d.c. sets. As the power requirements of this type of dredge are low, one main generator usually supplies all motors. This generator may be engine or steam turbine driven.

The ladder type dredge utilizes the principle of tandem operation throughout, speed and load requirements of any motion depending upon the material delivered to it by the previous operation. A means for accurately controlling the speeds of the digger, screen, and elevator drives is essential to efficient operation. In most cases, 50 per cent speed reduction on motors for the above drives is sufficient.

Getting Down to DETAILS

Close-up Shots of Job Methods and Equipment

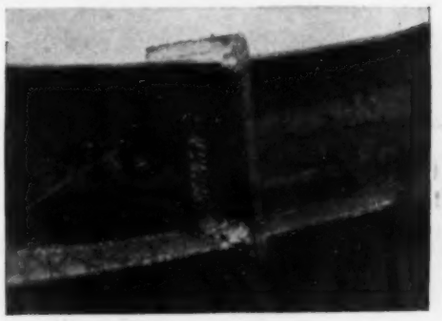
BAR JOISTS WITH NAILER STRIPS (*left and below*), manufactured by Macomber Steel Co., facilitate construction of wood roof decks on hangar being built for Universal Aviation Corporation at Memphis, Tenn. Stock size joists to fit 29-ft. span eliminate cutting and fitting operations. Workmen nail 1-in. decking directly to wood members of joists, which are 16 in. deep.

HOLDING 34-TON VAULT DOOR SUSPENDED (*below*) while workmen place cribbing beneath load. A. Morgan Hauling & Express Co., St. Louis, handled this job with Willamette-Ersted single-drum Hyster hoist mounted on a Caterpillar 60 tractor.

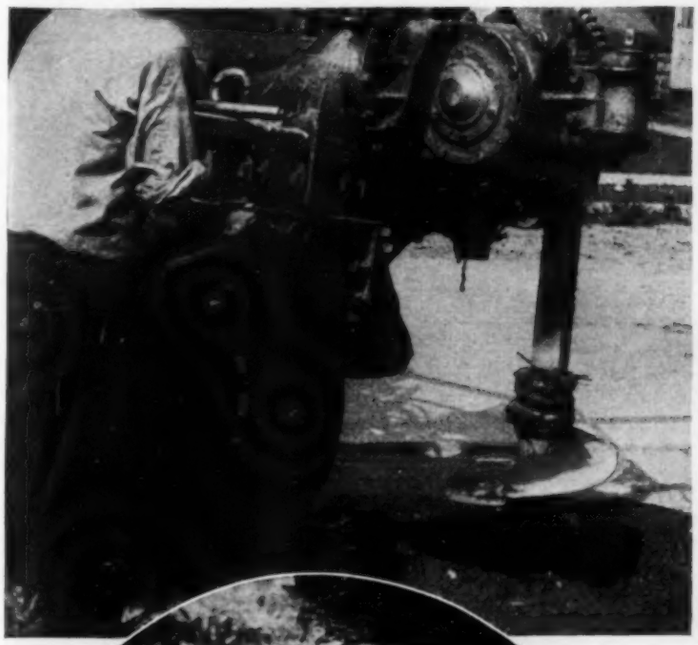
REPLACING OLD STACK WITH NEW in 28 hours. New 125-ft. steel stack, used as gin pole, first dismantles old stack. Stearns-Roger Manufacturing Co., contractor.

***Photo from* R. W. WOOD**
Stearns-Roger Manufacturing Co.
Denver, Colo.

LAND LEVELER pulled by Monarch 75 tractor aids in 500,000-yd. grading operation which the A. F. Hartigan Co., Hammond, Ind., performed for an addition to the Gulf Refining Co.'s plant at East Chicago, Ind. Soil is mostly sand.



WELDED GIRDER SPLICE (*right*) using plate between beam ends, developed by A. W. Schenker, Electric Welding Co. of America, Brooklyn, makes deflections under load approximately equal to those of unspliced beam.



POWER-DRIVEN AUGER, mounted on truck, digs post holes for American Telephone & Telegraph Co. Caisson retains walls of hole in soft and muddy soil.

BRIDGE MEMBERS SERVE AS FALSEWORK for Kansas City Structural Steel Co. in erecting highway bridge over Current River in Missouri.

***Photo from* J. G. LESTER**
Project Engineer, Missouri State Highway Dept., Ironton, Mo.

PRESSED STEEL PLATES
Reduce Tunnel Lining Cost

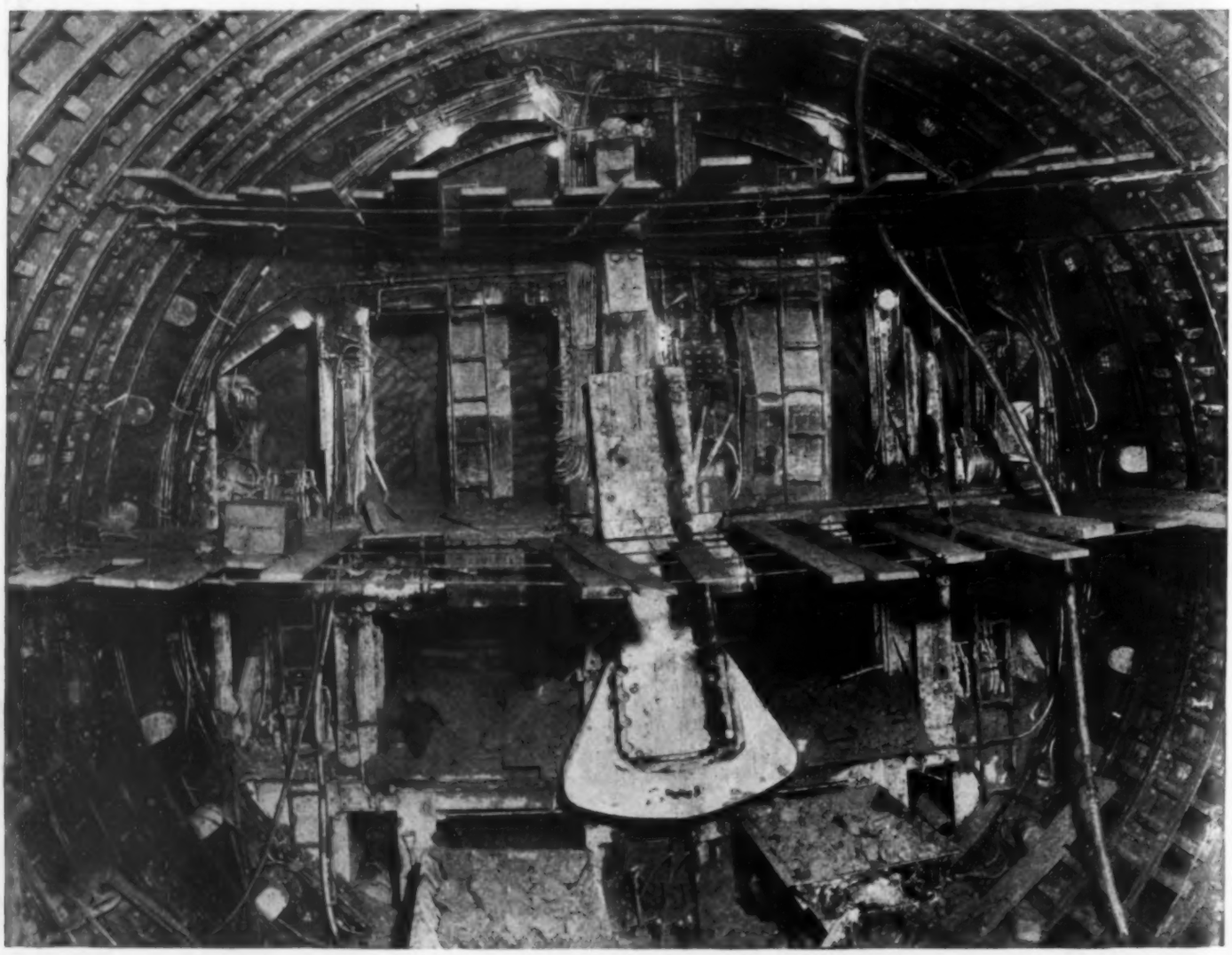
SHORE sections of the Detroit-Canada tunnel under the Detroit River, connecting the commercial districts of Windsor, Ont., and Detroit, Mich., consist partly of box-type subway and partly of shield-driven tunnel. As the profile of the tunnel on p. 37 of last month's issue of *Construction Methods* indicates, the shield-driven portion on the Detroit side is 466 ft. long and on the Windsor side is 986 ft. in length. The construction program calls for completion of the Detroit shield-driven section before work is started on the portion in Windsor.

Shield-Driven Tunnel—The shield-driven tunnel is circular in section, with an outside diameter of 31 ft. 8 in. A primary tunnel lining of pressed steel plates reinforced by structural steel members is covered with an interior concrete lining 22 in. thick. Excavation proceeds with the aid of a shield which is advanced through the soil by jacking against the structural steel lining.

The shield has a diameter of 32 ft. $3\frac{5}{8}$ in. and an overall length of 15 ft. $3\frac{1}{2}$ in. Three horizontal and four vertical girders divide the open face of the shield into a number of working compartments and brace the ring of thirty 250-ton hydraulic jacks. A hydraulically operated erector arm in the shield places the liner plates.

Steel Lining—The liners are 2 ft. 6 in. wide, and the steel lining of the tunnel is made up of rings of these liners, each ring being composed of eleven segments and a key section. As the shield advances, with each shove limited to 2 ft. 6 in., a ring is added, making a continuous steel lining inside the bore.

A liner plate is made of $\frac{3}{8}$-in. steel plate bent into the shape of a U, with end plates and stiffeners welded on, at the plant of the Commercial Shearing & Stamping Co., Youngstown, Ohio. The 5-in. I-beam stiffeners, spaced approximately $13\frac{1}{2}$ in. apart, take the thrust from the jacks. Connections between segments and between rings



SHIELD FORMS PROTECTING RING PLATE around open face of excavation. Thirty hydraulic jacks, numbered in the photograph, force the skin plate forward by exerting pressure against the structural steel lining of the tube. Heavy erector arm, which can be rotated through 360 deg., places segments in each ring of steel liners. Small electric hoists on platforms of shield operate clay knives used in excavating stiff material. Conveyors are not shown in this photograph.

are made by bolting. The pressed steel liner plates not only reduce the weight of the lining to one-fourth of cast iron and cast steel, but also cut the cost to about 40 per cent of the heavier types.

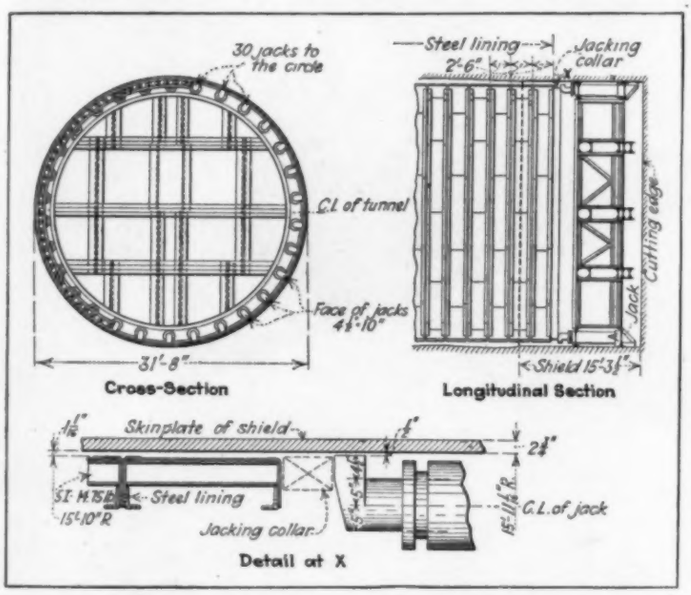
The steel lining, designed to sustain 45 ft. of liquid clay at 135 lb. per cubic foot, weighs 2.35 lb. per linear foot of tunnel. This weight compares very favorably with those of 8.65 tons for cast iron and 9.39 tons for cast steel in the Holland Tunnel tubes, which have somewhat smaller outside diameters of 29½ ft.

TUNNEL LINERS are made of ⅜-in. steel plate pressed into U shape and reinforced by end plates and stiffener I-beams welded on.

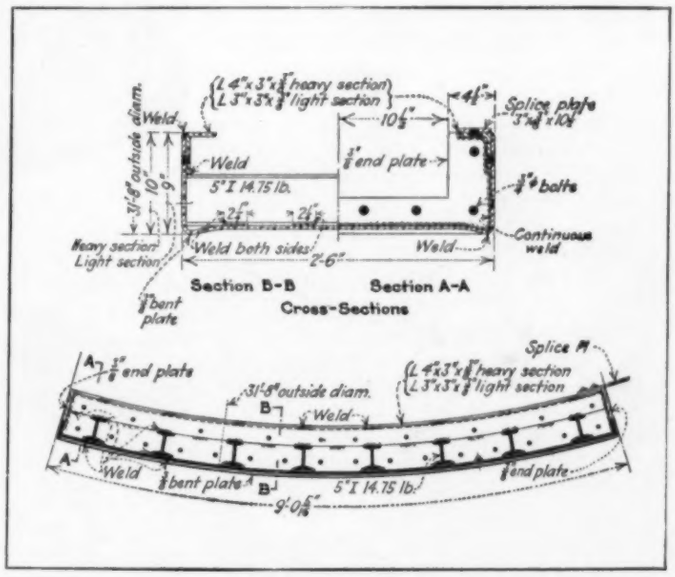
Conditions and Methods—The material through which the shield-driven sections are being constructed is stiff gray clay, practically impervious to water. On the Detroit side the bore was advanced to within 200 ft. of the river before the bulkhead and air locks were installed. The bulkhead, erected some distance from the shaft, consists of a steel plate diaphragm backed by heavy vertical and horizontal I-beams and equipped with two material locks and one man lock.

Material is excavated with clay knives operated by small electric hoists on the platform of the shield. The workmen dump the clay into chutes which deliver it to two belt conveyors discharging into 50-cu.ft. roll-over type steel muck cars 50 ft. to the rear. Electric hoists handle loaded and empty cars on both sides of the bulkhead.

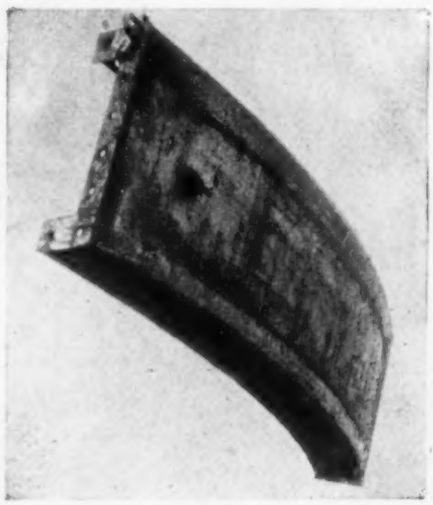
Joint With River Section—In preparation for joining the shield-driven tunnel to the river section described in last month's *Construction Methods*, the end of the subaqueous tube is covered with earth in time to allow the fill to consolidate before it is entered by the shield. The river tube is equipped with a bell end which the shield enters, advancing until the skin plate comes in contact with the vertical flange of the bell end. Electric welders, working under about 30-lb. air pressure, then weld the skin plate to the flange, making a water-tight joint. After dismantling the structural steel bracing of the shield, workmen continue placing the steel lining of the tunnel to the flange of the bell end. When the air pressure has been released, concrete lining is placed over the joint flush with the lining of the river tube.



THIRTY HYDRAULIC JACKS advance skin plate of shield by exerting thrust against steel lining. Jacking collar distributes load from jacks to steel ring.



SECTIONS OF STEEL LINER. Eleven segments of this design and a key section make up one ring of lining. I-beams take thrust from jacks.



GROUT HOLE is placed in each segment for use in filling void between back of lining and limit of excavation. End plates contain holes for bolts.

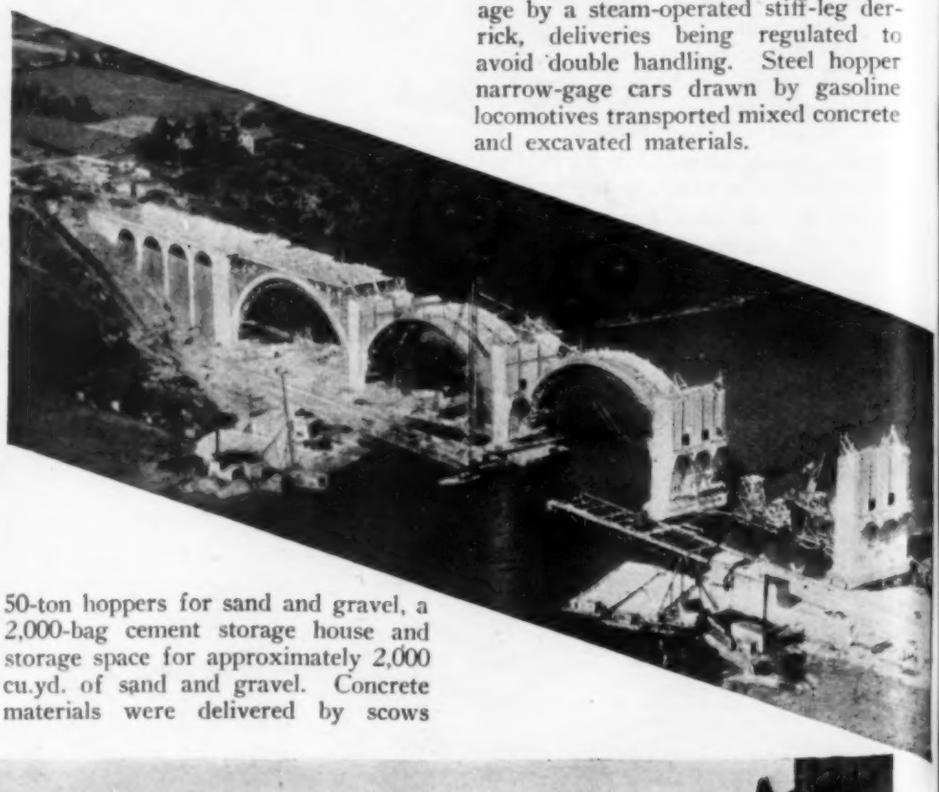
Parsons, Klapp, Brinckerhoff & Douglas, New York, are the engineers for the tunnel. In charge for this firm at Detroit are B. R. Value, executive engineer, and S. A. Thoresen, engineer of designs. The general contract for the shield-driven tunnel and for the river section is held by Porter Brothers & Robert Porter, Spokane, Wash., Northern Construction Co., J. W. Stewart & Welch, Montreal and Detroit, are building the shield-driven sections under subcontract with Porter Brothers & Robert Porter.

Movable Towers and Hinged Trusses Aid Concreting of MULTIPLE-ARCH BRIDGE

USE of hinged trusses in fabricating arches and of movable towers in distributing concrete greatly facilitated erection of the new multiple-arch bridge across the Raritan River at New Brunswick, N. J. The bridge, 1,902 ft. long, has six 200-ft. main arch spans and a number of 40-ft. semi-circular barrel approach spans. A 50-ft. roadway is flanked on either side by a 6-ft. footwalk protected by concrete balustrades.

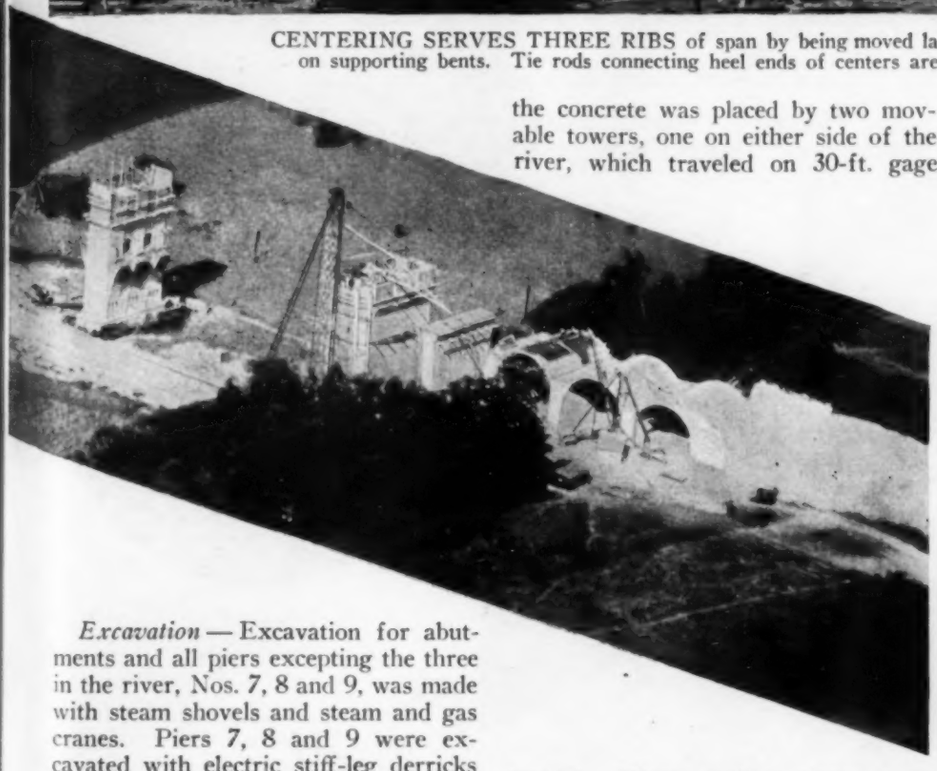
Plant Layout — Because of the length of the bridge and the limited time for completion (18 months) the contractor, Parker & Graham, Inc., of Paterson, N. J., decided to carry on the job from two plants, one on each side of the river. As the river is navigable, economical delivery of materials was made by water to docks built by the contractor, with the exception of items not conveniently handled by water which were delivered by trucks.

Adjacent to the docks the concrete mixing plants were located, each consisting of a 1-yd. concrete mixer, two 50-ton hoppers for sand and gravel, a 2,000-bag cement storage house and storage space for approximately 2,000 cu.yd. of sand and gravel. Concrete materials were delivered by scows directly to the mixing plant or to storage by a steam-operated stiff-leg derrick, deliveries being regulated to avoid double handling. Steel hopper narrow-gage cars drawn by gasoline locomotives transported mixed concrete and excavated materials.



SET OF CENTERING, made up of six three-hinged trussed arches spaced 2 ft. apart, is erected in two halves. Each half is fabricated in two units of three trusses each.

CENTERING SERVES THREE RIBS of span by being moved laterally over sliding plates on supporting bents. Tie rods connecting heel ends of centers are used only in moving.



Excavation — Excavation for abutments and all piers excepting the three in the river, Nos. 7, 8 and 9, was made with steam shovels and steam and gas cranes. Piers 7, 8 and 9 were excavated with electric stiff-leg derricks in steel sheet pile open cofferdams of standard construction. The steel sheeting was driven 6 to 12 in. into the rock, affording a practically dry cofferdam.

Concreting—Concrete was batched by volume, the water being controlled by automatic measuring tanks, and the mixing time (1½ min.), by an automatic timing device. In all piers below the surface of the rock, concrete was poured the depth of the footing against the walls of the excavation. Five of the piers below the coping and springing lines were poured with bottom-dump buckets handled by cranes or electric derricks. The remainder of the concrete was placed by two movable towers, one on either side of the river, which traveled on 30-ft. gage tracks. These mobile plants were equipped with Insley towers 160 ft. high, electric hoists, 50-ft. booms and 50-ft. counterweight chute plants. The trestles on which they traveled extended out into the river within 112 ft. of each other, this span being left clear for navigation. One of the towers is shown on the cover.

Sectional forms designed for extensive re-use were employed in constructing the pier shafts. Main span piers were completed to full height before centering was begun. The 40-ft. earth-filled semi-circular barrels of the approach arches were poured on timber truss centering supported on beams set temporarily in the piers.

Centering—The ribs of the main spans were erected on steel centers designed as three-hinged trussed arches, three sets of centering being used for the eighteen arch ribs of the entire structure. A set of centers consisted of six trusses, spaced 2 ft. apart and made up in two units of three trusses. Each truss consisted of twelve 20-ft. sections joined together, except at the crown hinge, by wedge-shaped fillers to form the arch. They were supported on inclined steel bents resting on base plates set in the piers.

The centering was assembled in half-span lengths, the heel ends being set on their supports at the piers and the adjoining sections balanced on two timber towers for each half span at a height to permit complete assembly of halves without interference in lapping. The half-span was raised by a hoisting frame anchored to the top of the pier. A 3-hp. electric motor lifted the unit, uniform speed being maintained to avoid excessive stresses.

The steel bents were surmounted by sliding plates to be used in shifting the centers to adjacent ribs. In shifting the centers laterally, all but one wooden side form were left in place, making it possible to have a rib ready for pouring in 5 days after the striking of centers of an adjacent rib.

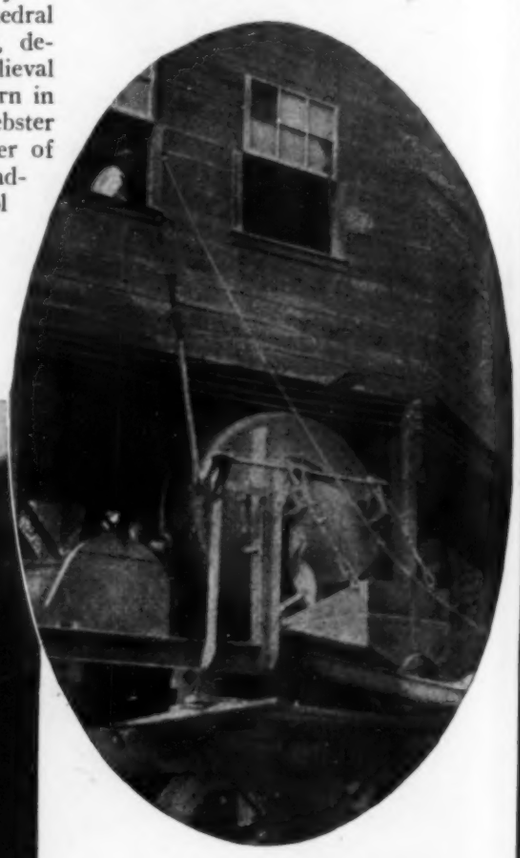
The bridge was built by the State Highway Commission of New Jersey, Jacob L. Bauer, state highway engineer. Morris Goodkind, bridge engineer, was in charge of design and construction. L. C. Petersen was chief draftsman and W. R. Ketels, resident engineer. Duncan MacDonald superintended the work for the contractor.

Building SKYSCRAPER

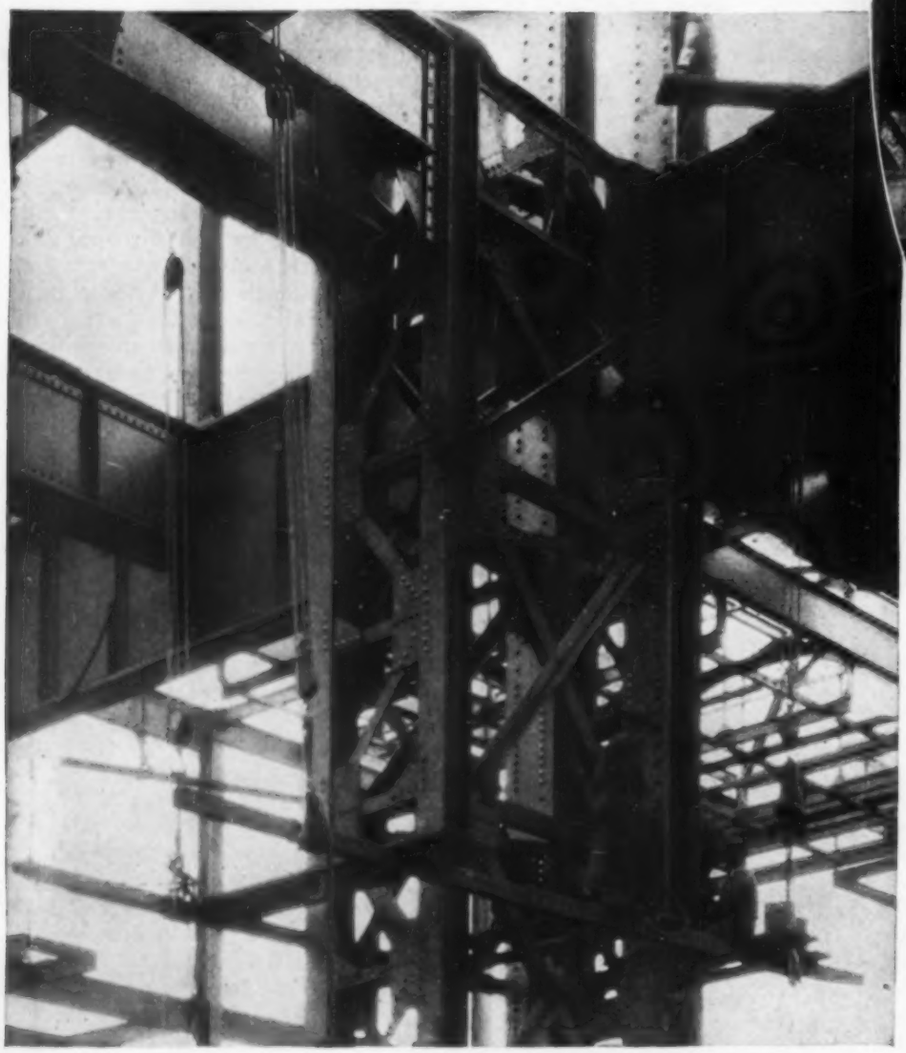
STEEL SKELETON of the Cathedral of Learning rises above Pittsburgh's civic center.

EFFECTIVE measures to reduce the fire hazard and a central mixing plant to serve the needs of numerous sub-contractors are among the most interesting features marking the construction of the University of Pittsburgh's boldly conceived Cathedral of Learning. To this building, designed with reverence for the medieval and with reliance upon the modern in architecture, the Stone & Webster Engineering Corporation, manager of construction, is applying the most advanced methods of unified control and protection against damage during erection.

Description of Building—The Cathedral of Learning, conceived by Chancellor John G. Bowman as a symbol of the spirit and achievements of the Steel City, is a monumental shaft in the modern Gothic style, rising 40 stories to a height 510 ft. above the ground. Class rooms, lecture halls and laboratories of the university are to be housed in the building. On the first floor is a great commons room, or indoor campus, 100x153 ft.x52 ft. high. Twelve automatic elevators will serve the 40 floors, including basement and sub-basement, of the building. Walls are brick faced with limestone.



MIXER CONTROL (*right*), including control of discharging, is localized on the operator's platform of the central concrete plant.

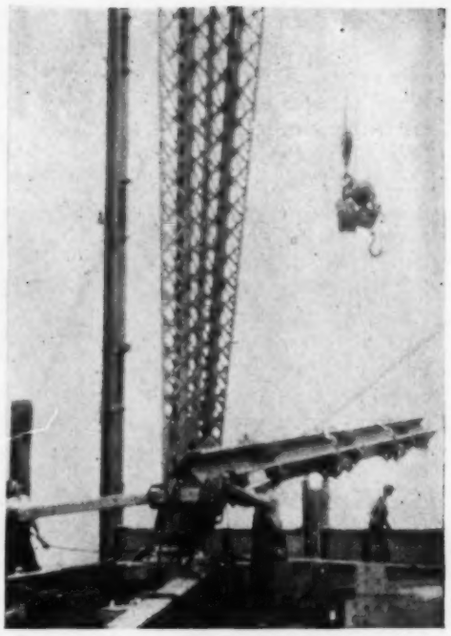


TRUSSED COLUMN (one of two in the commons room) carries concentrated load from number of columns which terminate at floor above.

The ground plan of the great structure is approximately 333x250 ft. Two main wings rise to the second story, and wings of the tower are set back in six places between the fourth and thirty-first floors. The tower is 80 ft. square.

A number of unusual structural features were incorporated in the building by H. G. Balcom, New York,

the First UNIVERSITY



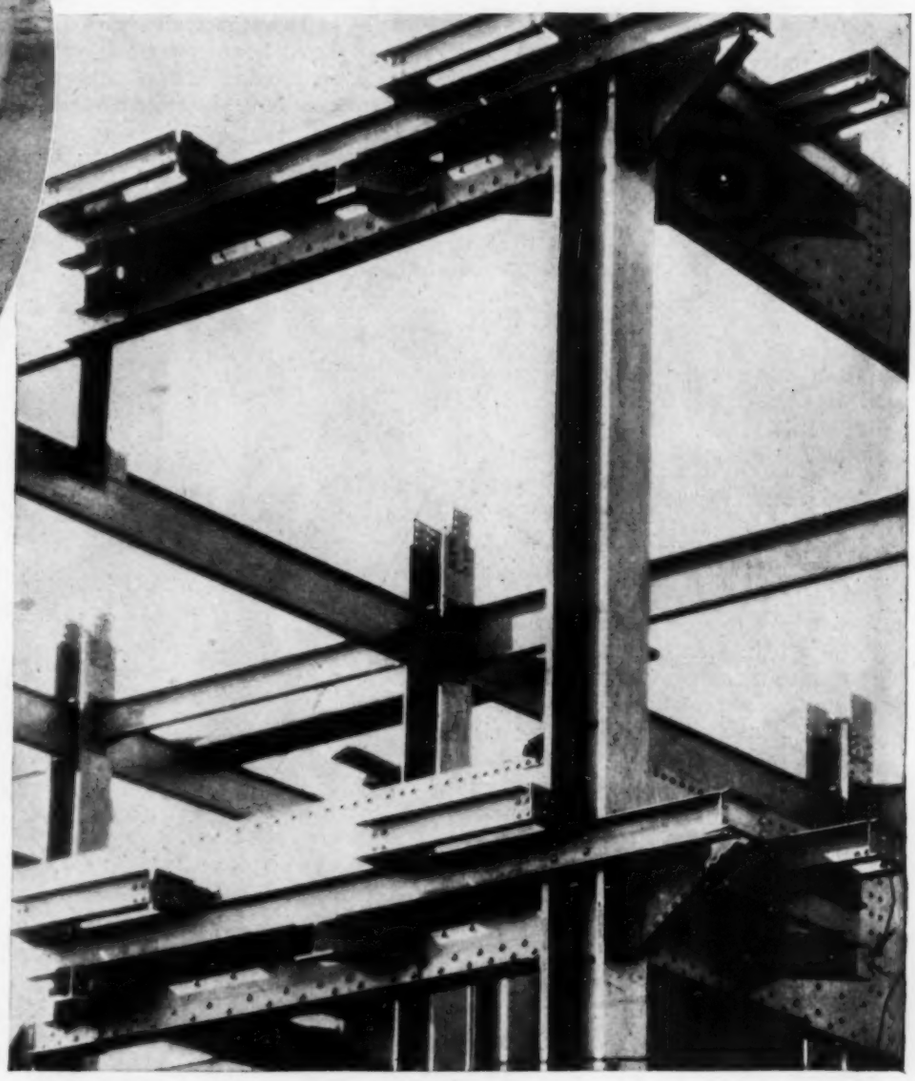
ONE GUY DERRICK, with 110-ft. mast and 100-ft. boom, handles all steel above eighth floor.

who was associated with the architect, Charles Z. Klauder, of Philadelphia, to design the steel. Among the most interesting of these are the built-up exterior channel beams which carry the walls and the cantilever brackets which support the buttresses.

J. L. MULLEN (*left*), president, John L. Mullen Construction Co.; and E. M. POST, superintendent, Stone & Webster Engineering Corporation.

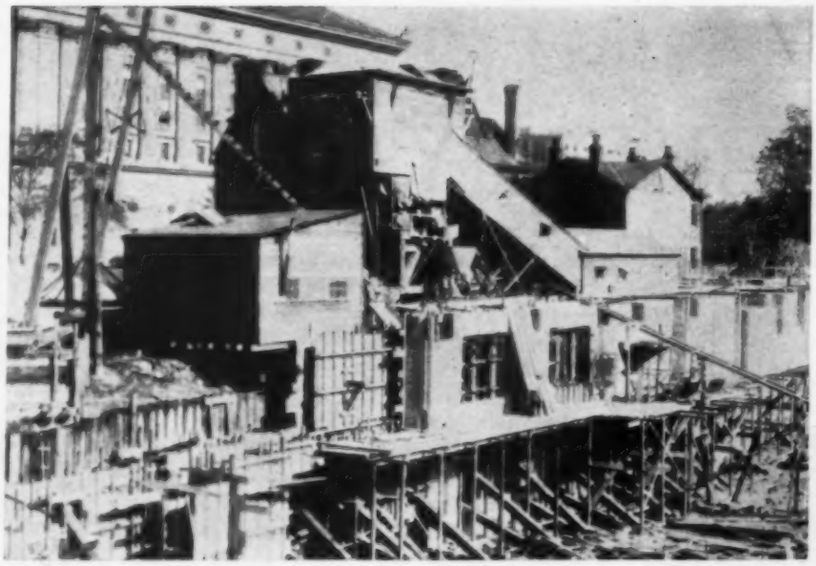
Central Mixing Plant—The Stone & Webster Engineering Corporation, manager of construction, takes all bids, awards all contracts and superintends operations. For several reasons the managing corporation decided that a central mixing plant for the benefit of all sub-contractors would be a great aid to efficient construction. Concreting operations fell under a number of sub-contracts, none of them calling for a great quantity: 5,000 yd. for the foundation caissons, 11,000 yd. for the basement walls and the floor slabs up to the fifth story, and 8,000 yd. for the upper floors. By providing one well-equipped plant to furnish the total quantity of 24,000 yd., the manager obtained accurate control of mixes and made large concrete production certain under all contracts. The plant also equalized opportunity for all contractors in bidding on various portions of the work, no great advantage resting with the concern which was finishing a previous contract.

The central mixing plant was erected at the high side of the excavation, where it could chute concrete to part of the foundation area, and later, to a hopper at the bottom of the hoist installed in one of the elevator shafts. Sand



CANTILEVER BRACKETS to carry buttresses consist of column bracket and of cantilever beams supported by webs of deep channel girders which carry curtain walls.

and gravel are dumped from trucks at the top of a ramp. A stiff-leg derrick, operated by an American electric hoist, lifts the aggregate to 117-ton Blaw-Knox steel bins with a Williams ¾-yd. clamshell bucket. Cement is delivered to the charging platform by a Barber-Greene belt conveyor, and aggregates are measured in a Blaw-Knox batcher and inundator. Electric mixer control and discharge lever are operated from the inclosed charging platform. A crew of four men on this platform operates the plant.



CENTRAL CONCRETE MIXING PLANT is placed at high side of excavation to chute concrete to some foundation piers and, later, to bottom of hoist inside building.

Concrete for the floors of the building, having a slump of 3 to 4 in., is discharged down a 120-ft. Lakewood chute on a 25 per cent grade to a 2-yd. hopper at the bottom of the hoist, which is installed in an elevator shaft. No tower is erected in the shaft. Instead, tubular elevator guides are bolted to 4x6 timbers, and the timbers are clamped to the floor beams with U-bolts. An extra long cathead is supported on steel framing at one of the floors. To pour the top floor of the building three sections of American Tubular Elevator tower, giving a height of approximately 18 ft., will be erected on the top floor steel. The 1-yd. concrete bucket was made to fit a standard platform hoist, and the bucket can be removed when it is desired to install the platform for hoisting other materials. All equipment is operated by electrical power.

Fire Protection—Protection against fire is maintained in two ways: by the installation of equipment to extinguish fires when they occur and by the use of a watchman's telegraph reporting system to make sure that the structure is under observation at all hours. A 535-ft. four-cycle Dayton-Dowd electric pump is connected temporarily to a 2½-in. wrought iron permanent gas pipe which serves as a temporary water line. The gas pipe has a 1½-in. outlet at each floor, intended to serve laboratories, etc., after the building is completed. Eight hose reels containing 100 ft. of 1½-in. hose are clamped to the 2½-in. gas pipe and are moved up along with the forms, planking and other combustible material as part of the plumbing contract.

The installation of an American District Telegraph system is an added protection for the building in case of accident to the watchman during the night. At regular intervals, the watchman indicates his active inspection of the property by turning the keys of three boxes placed at various heights on the building. If a report fails to come in to the office of the telegraph company at the appointed time, the company immediately sends a man to the building.

As an aid to fighting any fires that may occur, a steel stairway is completed as close to the top of the steel structure as possible. An electric lamp is placed at each landing of this stairway. The illuminating system can be lighted from switches at either the bottom or the top of the stairway. Seven 2½-gal. fire extinguishers are distributed over the building: one at each hoist engine, one or two on planked floors for putting out blazes caused by hot rivets, and one or two on the stairways where needed. In addition to the large extinguishers, the job is equipped with several of the small hand size. The added protection against small blazes reduces the fire insurance rate sufficiently to pay for the cost of the extra safeguards.

The Builders—The R. M. Netherland Co., Pittsburgh, excavated the foundation with three Bucyrus steam shovels and the Dravo Contracting Company, Pittsburgh, built the foundation piers, using two whirler cranes for both removing muck and placing concrete. Contract for the 9,400 tons of steel erection was performed by the John L. Mullen Construction Company, Pittsburgh. Four derricks erected the steel to the fifth story. The McClintic-Marshall Company, which fabricated the steel, had a location plan of these derricks and marked all steel for delivery to the proper derrick, thus saving rehandling of structural members on the job.

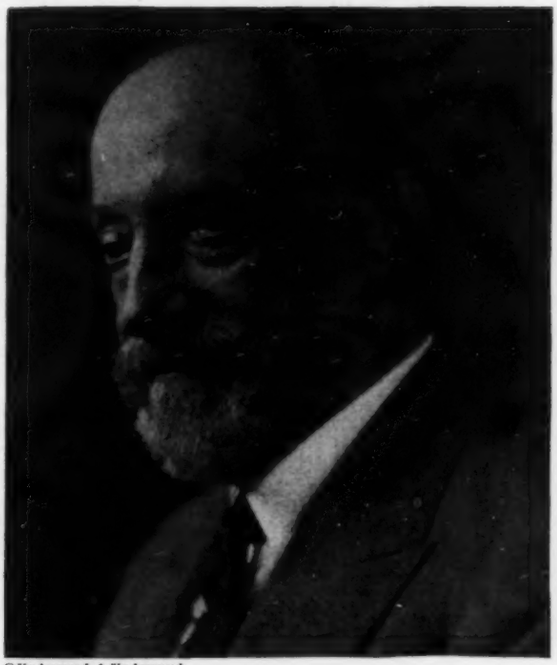
Construction of the reinforced concrete floors was divided between David T. Riffle, Pittsburgh, first to the fifth floor, and William F. Trimble & Sons Company, Pittsburgh, sixth to the thirty-seventh floor. David T. Riffle also built the foundation walls.

In addition to Mr. Balcom for structural design, Charles Z. Klauder had associated with him Tenney & Ohmes, Inc., New York City, for the preparation of plans and specifications for service equipment. E. F. Blakeslee, district manager, is in general charge for the Stone & Webster Engineering Corporation, and E. M. Post, superintendent, is resident supervisor of operations.

Present and Accounted For —

A Page of Personalities

HIGHEST HONOR of American engineers, the John Fritz gold medal, goes to RALPH MODJESKI (*right*) "for notable achievement as an engineer of great bridges combining the principles of strength and beauty." Bridges on which Mr. Modjeski has been engaged include the Quebec, Poughkeepsie, Philadelphia-Camden, and Manhattan (New York).



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IN CHARGE OF CONSTRUCTION for John A. Roebling's Sons Co. on great Hudson River bridge are these seven men (*left, right, and below*). W. E. JOYCE (*left*) is contractor's resident engineer. Roebling force started spinning of cables about middle of October.

FIRST TO CROSS 3,500 ft. main span by means of temporary erection cages traveling on footwalk cables is CHARLES J. MYER (*left*), chief draftsman, John A Roebling's Sons Co. Others in the photograph are (*left to right*) W. R. COPPAGE, superintendent; WADE CLINE, general foreman, New Jersey side; GEORGE BOWERS, general foreman, New York side; and OTTO PETERSON, carpenter foreman.

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FIRST TO WALK across completed footwalk of Hudson River bridge is CHARLES M. JONES, assistant resident engineer, John A. Roebling's Sons Co.

DRAGLINES AND PAVERS *Build Storm Drain*

DRAGLINES handle 120,000 cu.yd. of excavation for box section of storm drain. Shovels loosen earth so that draglines can move it more easily.

CONCRETE for walls and top of box is poured through 24-in. holes drilled in roof of tunnel by well drilling rig and is distributed by chutes into forms. Heavy timbering is required in tunnel because of street car lines and dense traffic overhead.

DRAGLINES handled 120,000 cu.yd. of excavation and pavers poured 20,000 cu.yd. of concrete in constructing the 8,000-ft. box section of the Sacatella storm drain No. 3 completed recently for the City of Los Angeles. The construction of this drain, which runs along several heavily traveled streets and through a densely populated apartment house section, required careful planning on the part of the contractor, Charles H. Johnston, of Los Angeles, both from the standpoint of distribution of equipment and materials and from the standpoint of handling the work so that the flow of traffic would be impeded or interrupted as little as possible.

Koehring 1¼-yd. draglines excavated the material and loaded it into trucks which hauled the earth to dumps or to backfills on the completed work. Storage space for excavated material was confined to a few vacant lots in the vicinity of the work, as little street space was available for stock piling. Along Sixth Street, excavation had to be made on the north side under one of the street car tracks of the Los Angeles Railroad Co. The traction company diverted its cars to the south track, thus lessening the vibration on the sides of the trench and permitting shoring to be moved and replaced while the forms were being set.

In crossing Vermont Avenue, an open cut was found to be the most desirable method of providing space for the drain. This cut was 35 ft. deep and required a double

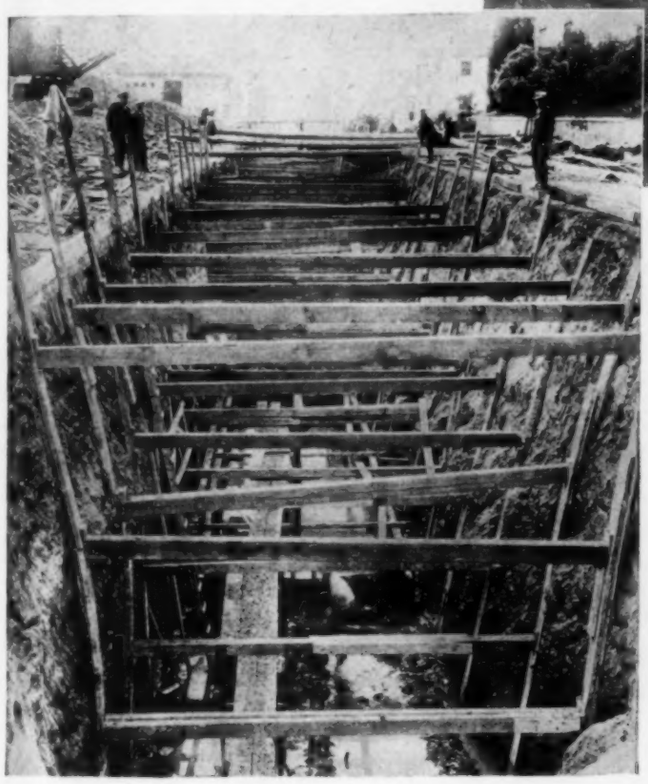
handling of material. Two draglines excavated the material and cast it as far as possible with their 50-ft. booms. It then was picked up by other draglines and re-cast to provide an average slope of ¼ to 1. An additional 10,000 yd. of material from a fill previously placed by the city had to be removed at this point.

The drain varied from 10 to 12 ft. in width and from 8 to 10 ft. in height, inside measurement, with 10- to 13-in. walls. Blaw-Knox steel ribs covered with 2-in. siding and the whole covered with 20-gage sheet iron were used for the inside forms. These sections were 20 ft. long. The outside forms were made up of sections 4 ft. long and 12 ft. high.

Concrete was mixed by pavers in 6-sack 1:2:3½ batches and was deposited directly to the forms by steel chutes. The pavers traveled along the edge of the excavation as the forms were filled. Cement for each day's run was stockpiled along the trench and dumped into the skips by hand. With the invert, a stub of wall 6 in. high also was poured to serve as a guide in lining up the inside and outside forms.

At the intersection of Temple and Hoover Streets a tunnel 12 ft. wide and 16 ft. high was constructed. Heavy timbering was required for this tunnel due to the street car lines and heavy traffic overhead. In pouring the walls and top of the box on the tunnel section, a common well-drilling rig drilled 24-in. holes at intervals along the center line of the drain. Concrete was poured into these holes and was distributed by chutes into the forms. Head room enough for men to work was provided between the box and the roof and this space later was backfilled with crushed rock.

Mr. Johnston did the work under sub-contract from the J. F. Shea Co. H. J. Brown was in charge for the contractor and A. Bradbeer looked after the interests of the city.



PAVER (*above*) on surface level provides concrete for box section, moving along edge of trench as forms are filled. Cement sufficient for each day's run is stockpiled along trench and dumped into skip by hand.

SECTION OF TRENCH (*above*), showing method of shoring. Depth here is 25 ft.; width, 30 ft.

INVERT AND REINFORCING (*right*). Stub of wall 6 in. high is poured with invert to serve as guide in lining up inside and outside forms.

NEW EQUIPMENT ON THE JOB

Pavement Sampler

The new pavement core drill manufactured by the Sullivan Machinery Co., of Chicago, affords highway officials a convenient means of taking samples of completed pavements. This ma-

chine drills a core that gives a cross-section of each layer of the foundation and of coarse and fine concrete surfacing.

This tester is operated by a gasoline engine, weighs about 900 lb., and can be mounted on a light motor truck. The standard bit removes a core 5¾ in. in diameter at the rate of 1 ft. in 15 or 20 min., and cuts a hole 7 in. across. With core barrels of ordinary length, this machine will drill to a depth of 24 in.

One-Man Screening Plant

A combination of a Barber-Greene bucket loader and Leahy Diester screen has resulted in a one-man excavating, loading and screening plant that is self-propelled, self-loading and self-contained.

The bucket loader throws the gravel

into a screen against a deflector which breaks the impact of the discharge and spreads the material before it hits the primary screen. The roof-like primary screen, which is vibrated by a take-off arm from the same drive that vibrates the main screen, again spreads the material, retaining the oversize material for rejection.

The 4x5-ft. fine mesh screen, vibrated at 1,600 v.p.m. by the bucket loader power unit, then receives the material, and its selection is chuted off directly by the loader into trucks. The fines drop on to the conveyor and are carried off with the oversize.

Light All-Purpose Drill

A light, all-purpose drill that can be used for wet or dry drilling is being produced by the Gardner-Denver Co.,

Denver, Colo. Although it weighs only 50 lb., the manufacturers claim for it a drilling speed equal to that of much heavier machines. It is rotated by rifle bar and rachet.

This new drill may be mounted for light drifting, for channeling with a quarry bar, for use on a tripod or for miscellaneous work where a light, mounted drill is desired. It takes steel from ⅞ to 1 in.

In ordinary operation this drill keeps the hole clean and free from cuttings by sending a strong air current through the drill steel, but in drilling unusually deep holes a special blowing device may be turned on.

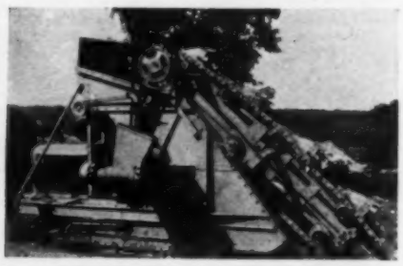
Bulldozer Attachment

A bulldozer weighing 475 lb. recently has been perfected by the Rome Manufacturing Co., Rome, N. Y., for attachment to its graders. The bulldozer is attached to the front end of

the grader and operated from the rear platform, the 17x22-in. blade remaining perpendicular at any height.

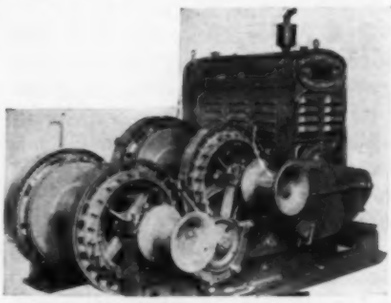
For Medium-Size Trenches

An "in between" size trench machine has been introduced by the Parsons Co., Newton, Iowa. It has two



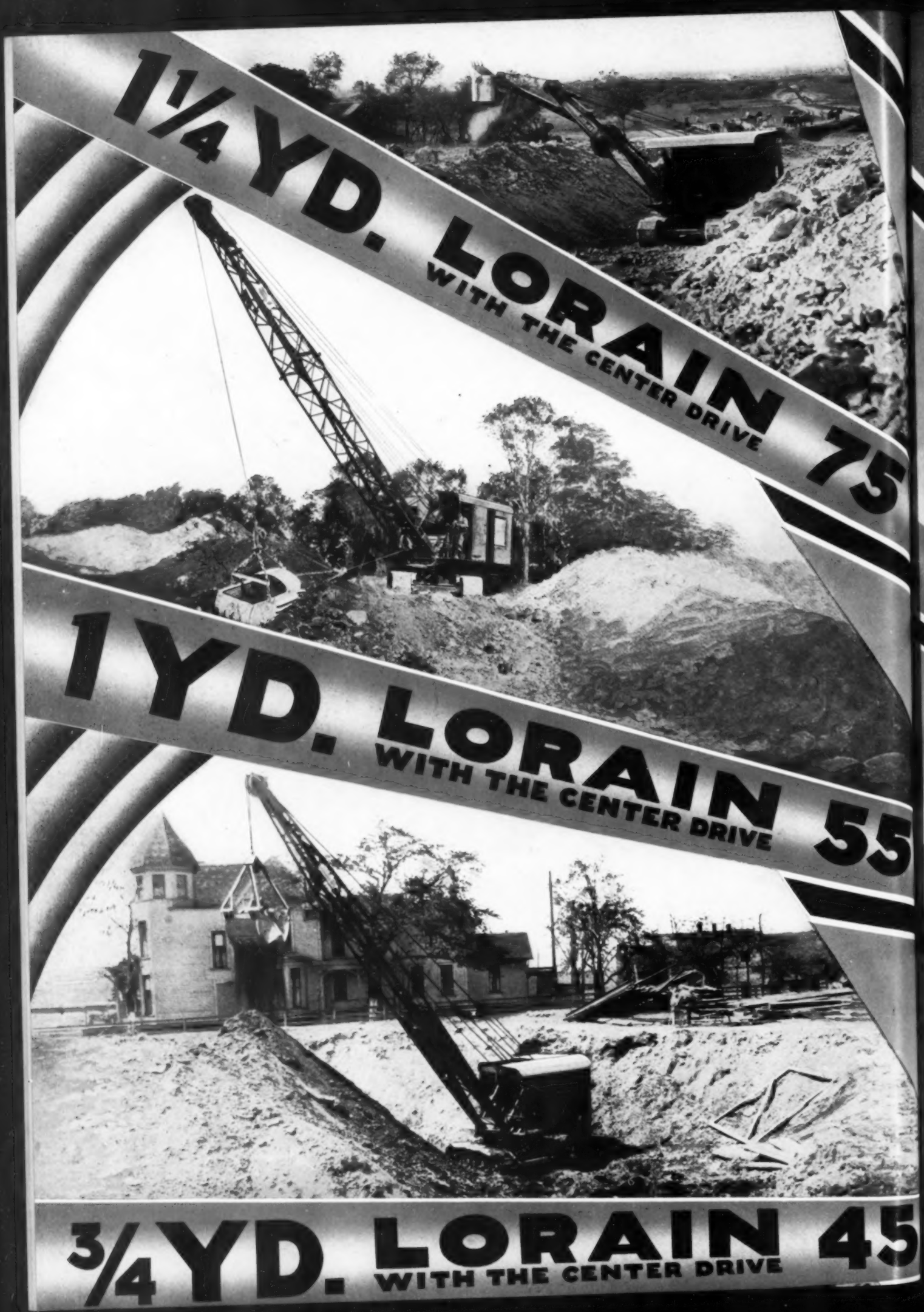
bucket-line speeds and two conveyor speeds which combine with four traction speeds for fast digging. It will dig to depths of 10 ft., to widths of 15½ to 42 in., and at speeds up to 12 ft. per minute.

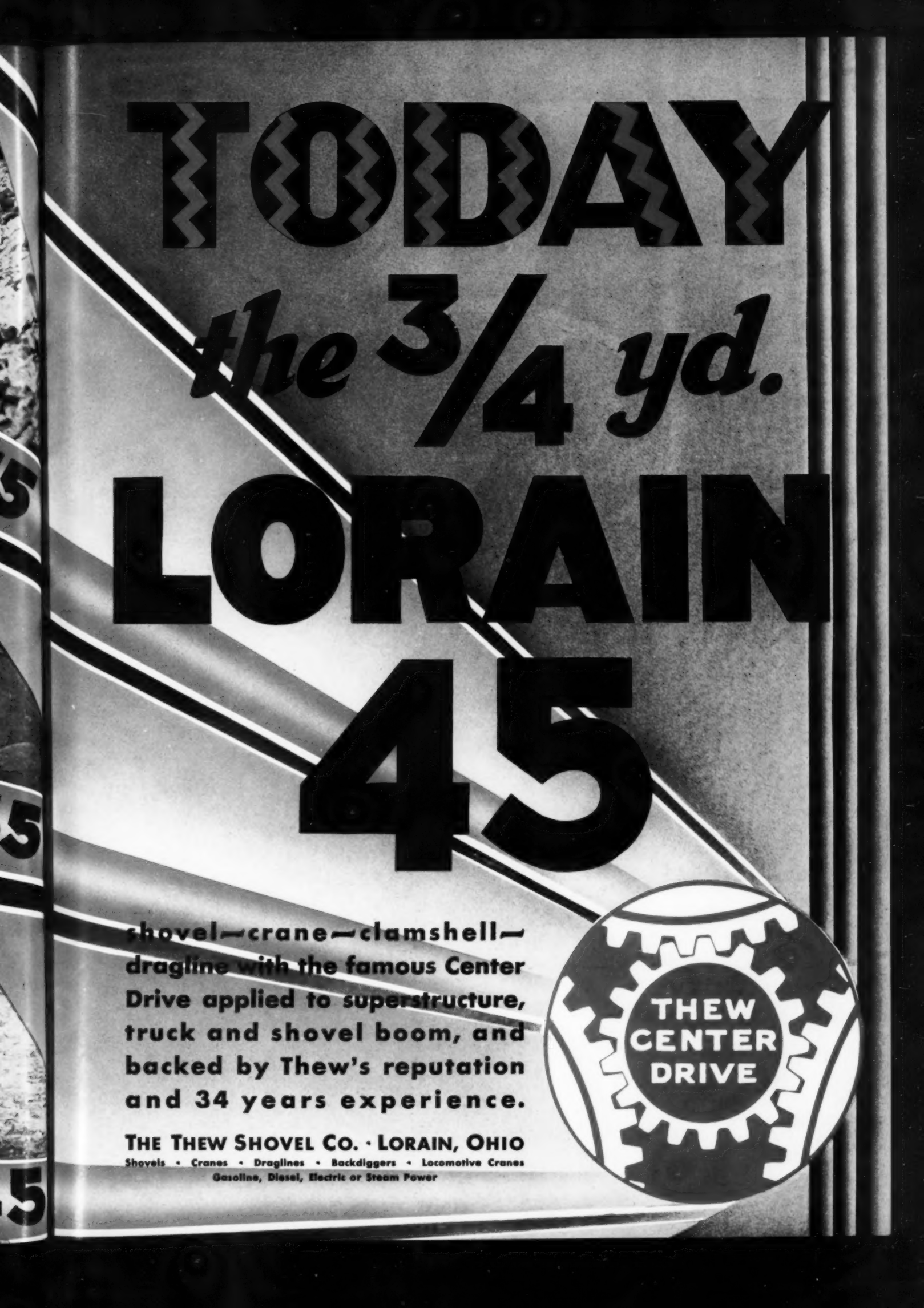
Hoist With Safety Feature



A gasoline hoist with an irreversible brake mounted on the center jack shaft as a safety feature has been developed by the Thomas Elevator Co., of Chicago. This new machine is Timken roller bearing equipped and has ventilated brake surfaces on the opposite end of the drum from the band frictions.

NEW
DRIVE
FROM
THEW


1¼ YD. LORAIN 75
WITH THE CENTER DRIVE
1 YD. LORAIN 55
WITH THE CENTER DRIVE
¾ YD. LORAIN 45
WITH THE CENTER DRIVE


TODAY
the 3/4 yd.
LORAIN
45
shovel—crane—clamshell—
dragline with the famous Center
Drive applied to superstructure,
truck and shovel boom, and
backed by Thew's reputation
and 34 years experience.
THE THEW SHOVEL CO. · LORAIN, OHIO
Shovels · Cranes · Draglines · Backdiggers · Locomotive Cranes
Gasoline, Diesel, Electric or Steam Power
THEW
CENTER
DRIVE

{Above}
One of the four Thew Lorain 75 machines owned by Peterson Shirley and Gunther, Omaha, Nebraska, operating as a dragline on the Lake Waco Dam project.

{Below}
The Monolith Portland Cement Co., Monolith, California, operates this Lorain 75 electric shovel in their quarry, handling about 900 yds. of rock per day.

{Above}
One of the five Thew Lorain machines owned by Spencer White & Prentiss, national foundation contractors. Operating with a 70ft. boom, driving sheet piling on the Cleveland Union Terminal job.

{Above}
One of the three Thew machines owned by the Dennings Point Brick Co., Beacon, N. Y., digging stiff, sticky clay.

{Below}
One of the two Thew Lorain 75's owned by the Penbrook Drayage & Supply Co., Harrisburg, Pa. making a big excavation in the shadow of the Pennsylvania State Capitol, loading from 400 to 500—3 yd. trucks in 10 to 11 hrs.

{Above}
R. G. Lassiter Co., Raleigh, N. C., operate 8 Thew Lorains. This Lorain 55 crane is handling all the materials for a big road job at Clearwater, S.C.

{At left}
Geo. J. Atwell Co., Inc., New York City large general contractors, handling basement excavation with their powerful Lorain 75 shovel.

{At right}
Ernest Lorenz, Roseville, Mich., not only digs the sewer trench with this Lorain Backdigger but also uses the independently and accurately controlled tilting dipper to set the sewer tile to a precise grade.

See the Lorain 45 at the Road Show

POWER to keep the dirt moving

EVERY road builder and dirt moving contractor knows that profits come from steady, continuous operation. Shutdowns due to insufficient power may hold up the whole job. You can't call "time out" for delays — the overhead keeps right on *all* the time.

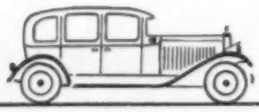
In Allis-Chalmers Monarch Tractors road builders and earth movers have found power that meets emergencies and keeps the dirt moving under the most difficult conditions.

The unusually long tracks give greater traction. The steering clutches and truck-type steering wheel enable the operator to steer naturally, easily and accurately.

Monarchs are made in two sizes—the "75" and the "50". Descriptive booklets gladly sent on request.

ALLIS-CHALMERS MANUFACTURING CO.
Specialists in Power Machinery Since 1846
Monarch Tractors Division SPRINGFIELD, ILL.

Allis-Chalmers
Monarch Tractors



The foot-throttle gets a work-out, *here!*

The smooth concrete road which links Augusta with Savannah, in Chatham County, Georgia—protected by Carey Elastite Expansion Joint, installed transversely at regular intervals.

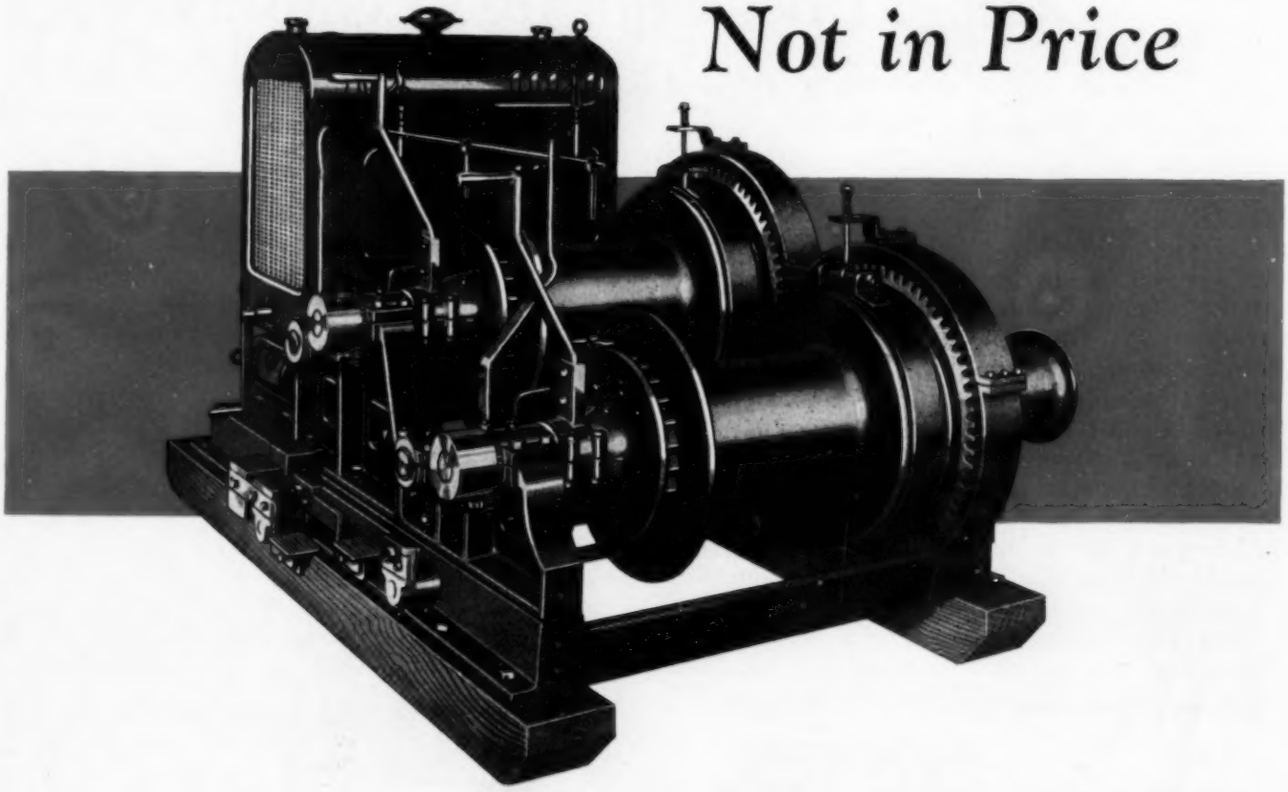
MOTORISTS who tour through Georgia this winter will have pleasant recollections of the concrete road unrolling south from Savannah. It is *wrinkle-proof*, that smooth, inviting highway, because it is protected against pockets and bulges by Carey Elastite Expansion Joint.

Carey Elastite Expansion Joint, properly installed at frequent intervals, is a surface-smoothness guaranty for concrete—a give-and-take absorber of expansion and contraction strains. The economical construction improvement that adds to the life of concrete, the weather-proof, pioneer "sandwich" joint in service in every State in the Union. Write for particulars about Expansion Joint installations.

THE PHILIP CAREY COMPANY, *Lockland,* CINCINNATI, OHIO

Carey Elastite EXPANSION JOINT

True Economy Is in Results— Not in Price



The Model Illustrated

The Model 40-A shown above is one of the six heavy duty series ranging from 25 to 50 horsepower.

Rating 4,000 to 5,000 pounds single line pull at 200 feet per minute with big reserve; 35 to 50 Horsepower; 12-in. diameter drums; 2—15/16-in. main shafts; 5 ½-in. face bronze bushings; Exclusive Bronze Screw Thrust with Positive Clutch Release; Timken and Ball Thrust Bearings; 3 ¼-in. face, 2 ½ diametrical pitch nickel semi-steel machine cut gears; side frames cast separate from bed; pawl ratchet separate from drum; gears separate from cones; non-spreading side frames; Alemite lubrication throughout; flanged gear guards; spring suspended brakes. Double or triple drums attached at any time.

MORE and more Contractors are continually placing dependence upon BROWN "GIANT-LINE" HOISTS—dependence in keeping the job moving speedily, surely, profitably!

In the heavy duty class there are now available six power combinations—25-30-35-40-45 and 50-HP. each representing an outstanding value in its power class.

And yet, BROWN "GIANT-LINE" HOISTS are manufactured not from a price angle but with in-built service and dependability as first considerations.

One standardized design, coupled with twenty-five years' specialization in the manufacture of Hoists, our own thoroughly modern Foundry and machine tool equipment have, however, enabled us to produce for you "The Greatest Hoist Values Ever Offered."

There is a BROWN "GIANT-LINE" HOIST adapted to your requirements ranging anywhere from 4 to 50-HP. in single or multiple drum combinations, non-reversible, reversible or conveyor types; also boom swingers.

New 1930 Catalog T, valuable Hoist Manual and Price Lists sent you upon request.

THE BROWN CLUTCH CO.
Sandusky Ohio, U. S. A.

BROWN
SINGLE & MULTIPLE DRUM – REVERSIBLE
GIANT-LINE
NON-REVERSIBLE AND CONVEYOR TYPES
HOISTS

HOIST SPECIALISTS FOR A QUARTER CENTURY

Thirty-one Turbinair Hoists now work for the Chicago Bridge and Iron Company

these 345-lb. air or electric hoists find profits where teams, tractors or large hoists lose

This company is one of many which have recognized the money-earning possibilities of the little Sullivan air and electric machines—which lift 2000 lbs. on single line or pull a 50-ton car on level track, at 110 ft. per minute. Neary every tank erection company has one or more Sullivan Hoists.

One of the hoists is shown here raising a 2000-lb. roof support for an 80,000-barrel oil tank which was erected in five weeks' time. The hoists also handle all the steel plates which make up the shell of the tank.

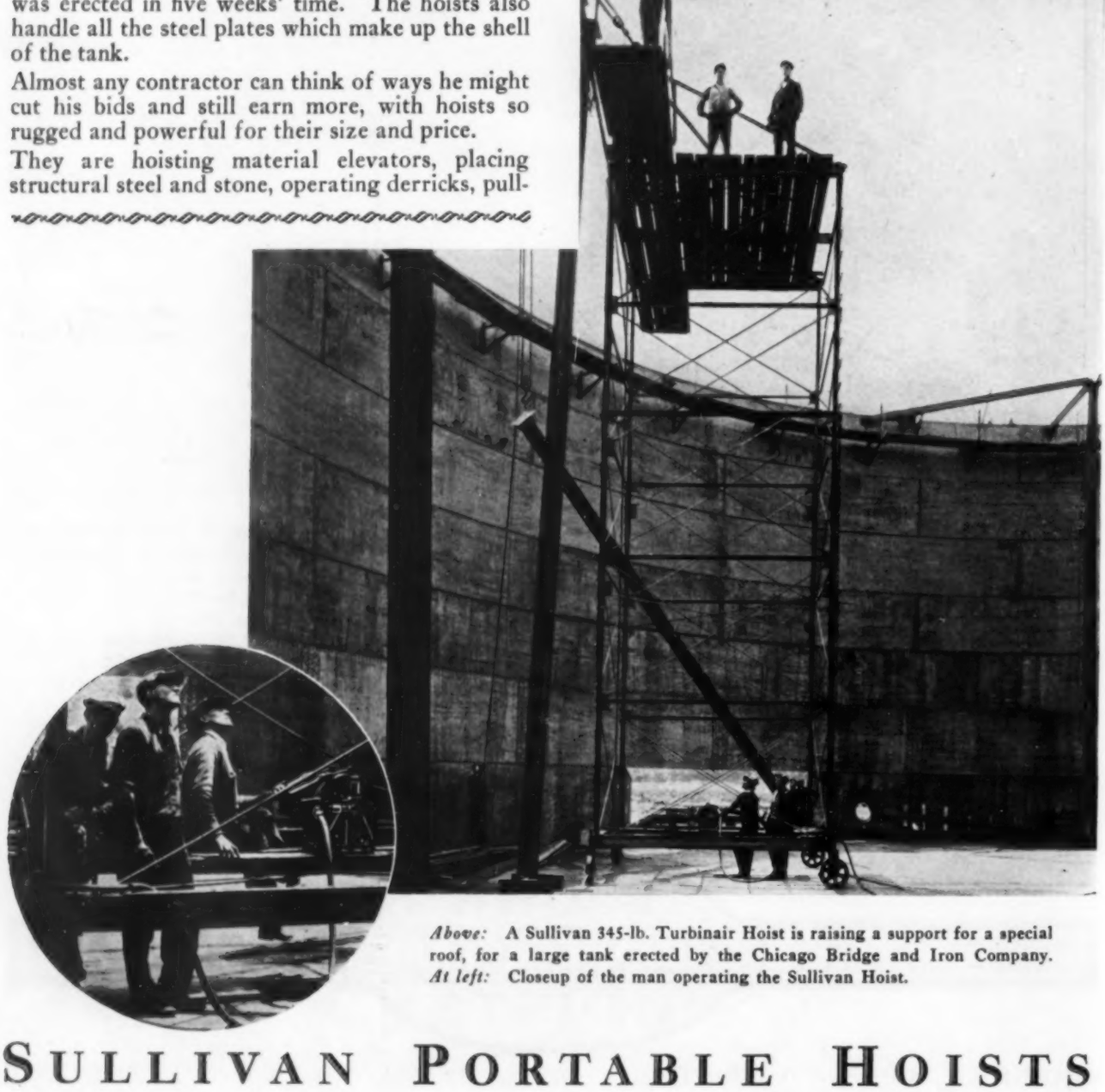
Almost any contractor can think of ways he might cut his bids and still earn more, with hoists so rugged and powerful for their size and price.

They are hoisting material elevators, placing structural steel and stone, operating derricks, pulling drag scrapers, pulling cars, and doing numerous other jobs.

Why not check below, the Sullivan Hoist Catalog you want, and write us for it today?

☐ *3—6½ H.P. Turbinair No. 476-F.* ☐ *3—6½ H.P. Electric No. 476-G.* ☐ *10, 15, 25, 35, 50, 75 Electric* ☐ *Scraper Hoists, No. 476-J.*

Sullivan Machinery Company
816 Wrigley Bldg., Chicago



Above: **A Sullivan 345-lb. Turbinair Hoist is raising a support for a special roof, for a large tank erected by the Chicago Bridge and Iron Company.** *At left:* **Closeup of the man operating the Sullivan Hoist.**

SULLIVAN PORTABLE HOISTS

One of the 12-ton Plymouths used in construction work for the D. T. & I. R. R. at Delta, Ohio.

One repeat order for a certain piece of equipment gives the manufacturer good reason to believe that his product has accomplished all that he had claimed for it. FOURTEEN repeat orders should prove this fact BEYOND ALL POSSIBLE DOUBT.

Walsh Construction Company, of Davenport, Iowa, own fourteen PLYMOUTH Gasoline Locomotives. And they were purchased at sufficiently long intervals to permit the thorough testing of any one of them before the next one was purchased.

Once you buy a Plymouth you will always want to use PLYMOUTH power. Thousands have proved this fact to their own satisfaction and profit. Why not you?

It would be a pleasure to send you complete information and prices on the Plymouth that will best meet your requirements.

14 PLYMOUTHS USED BY WALSH CONSTRUCTION COMPANY

PLYMOUTH LOCOMOTIVE WORKS
The Fate-Root-Heath Company
299 Riggs Ave.
PLYMOUTH, OHIO

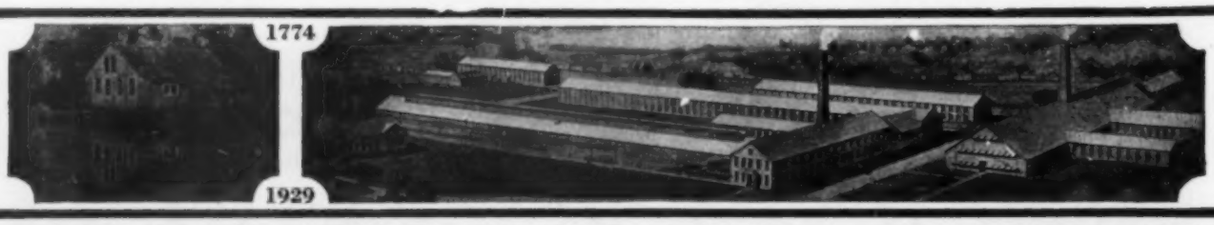
PLYMOUTH LOCOMOTIVES

PLYMOUTH
GASOLINE LOCOMOTIVES DIESEL

BUY AMES SHOVELS FOR REAL SERVICE

More AMES SHOVELS are used than any other kind

The complete "All Star" Ames Line covers every shovel need.
It will pay you to "Look for the Stars" on every shovel you buy.

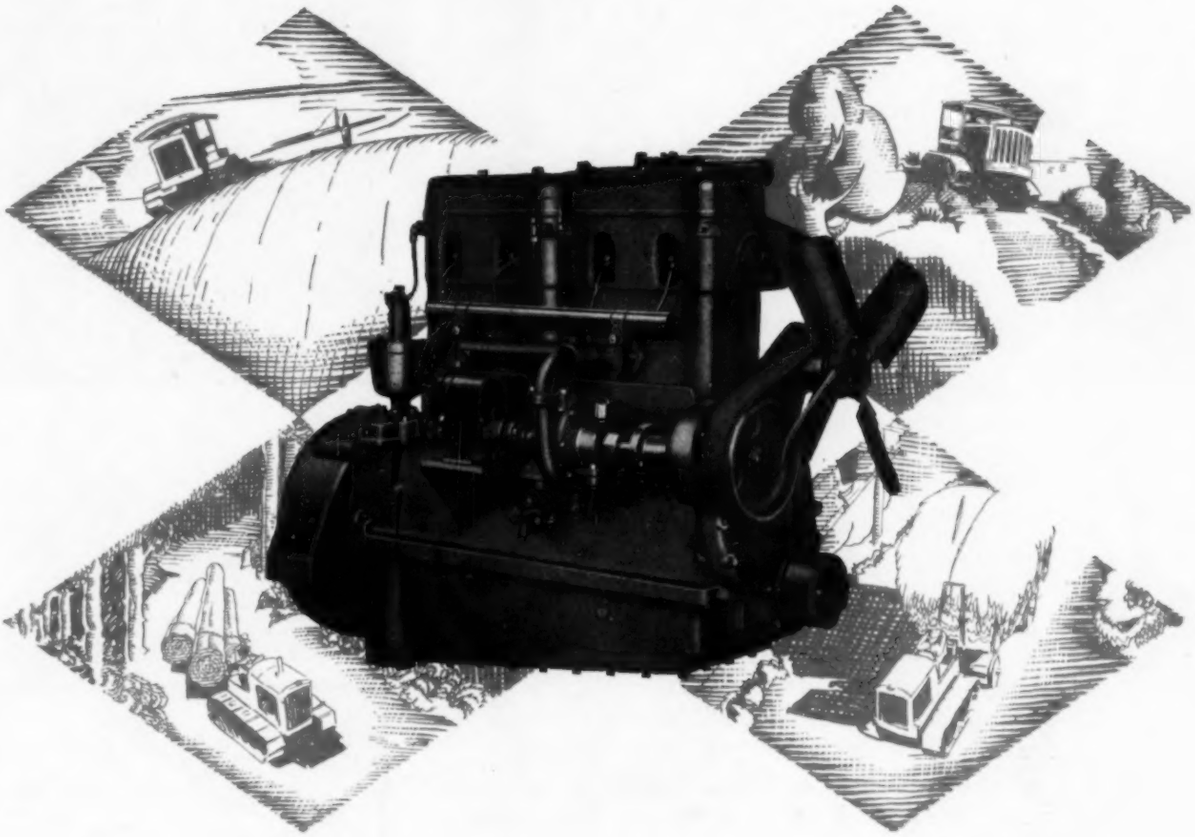


AMES SHOVEL AND TOOL COMPANY
NORTH EASTON ◂▸ MASSACHUSETTS
ST. LOUIS, MISSOURI · · · ANDERSON, INDIANA

3417

LE ROI

For Dependable Power



Why Le Roi Has Wide Acceptance

1

Le Roi Engines cost less to operate and maintain.

2

Le Roi Engines have "oversized" parts for greater power.

3

Le Roi Engines have a foolproof system of lubrication.

4

Le Roi Engines stay "active" longer.

5

Le Roi Engines are built by experienced and successful Engine Builders.

THE Le Roi Model "JA" is rugged . . . dependable . . . powerful. From every standpoint, the ideal heavy-duty engine. It is of the valve-in-head design, which gets the maximum power out of every explosion. "Oversized" working parts and vibrationless operation, and a fool-proof lubrication system assure dependable service over a long period of time. ***Write for special bulletin.***

LE ROI COMPANY, ***Milwaukee, Wis.***

LE ROI ENGINES

3 *to* 180 HORSE POWER

250% increased service with TRU-LAY

"It sure has done its stuff," says this user:

The operator of this Byers Bear Cat says: "The best recommendation that I can give for your rope is that I have given you three orders for Tru-Lay . . . We have plenty of digging for our Bear Cat, and have now used Tru-Lay for all kinds of shovel work. *It sure has done its stuff.*"

This is typical of reports from Tru-Lay Preformed Wire Rope users. In this case the average service of Tru-Lay is 21 days, as against 6 days with ordinary wire rope. Many firms are getting from 50% to 250% *increased* service from Tru-Lay. Few get less than 30%.

Let us send you a sample piece of rope—and our "Book of Facts for Every Wire Rope User." Address

AMERICAN CABLE COMPANY, *Inc.*
New York Central Bldg., 230 Park Ave., New York, N. Y.
DISTRICT OFFICES:
Chicago, Detroit, Philadelphia, Pittsburgh, Tulsa, San Francisco
An Associate Company of the American Chain Company, *Incorporated*

Canadian Licensed Manufacturers:
Dominion Wire Rope Company, *Limited*, Montreal
Canada Wire & Cable Company, *Limited*, Toronto

Actual photo of unseized end

Note how wires lie flatly in position—proof that there are no pent-up stresses within Tru-Lay Preformed Wire Rope.

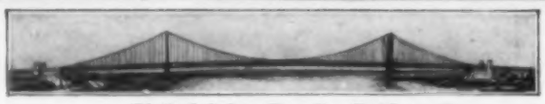
Let us send you a sample length of Tru-Lay Preformed Wire Rope, so you can see for yourself how each wire is formed to the exact shape it assumes in the finished rope. Unwind a strand and a wire. Place them back into position. The *preformed* construction of Tru-Lay is the reason for Tru-Lay's longer life and better wearing qualities.

PREFORMED WIRE ROPE

TRADE **TRU-LAY** MARK

(Reg. U. S. Pat. Off.)

Detroit International Bridge



Philadelphia-Camden Bridge
The World's Greatest Suspension Bridge

Mt. Hope Bridge
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More Material at Less Cost

UNITS AND TEAMS FOR ANY USE OR CAPACITY

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Complete $450.00

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SPEEDY
DURABLE

Another Universal Conveyor
Note Swivel Wheels

THE NEW UNIVERSAL
GRAVEL CAR
UNLOADER

COMPLETE REPAIR PARTS PLUS EXPERT SERVICE AT THE POINTS INDICATED
NATIONAL SERVICE

Operates without *ANY* pit

Loads onto *ANY* conveyor

Conveyor may work at any angle

Handles all loose material

Exceptionally low priced

Large volume CLEAN and SURE

CAR UNLOADER AND KING CONVEYOR FOR UNLOADING CAR IN 45 MINUTES

TERMS AND OUR 5 YEAR GUARANTEE

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Janesville, Wisconsin

Send catalog of Northern Conveyors and Car Unloaders.

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The MULTIFOOTE *power operator*

AUTOMATIC CONTROL *plus the* BRAINS *of the operator*

THE MultiFoote Power Operator permits taking advantage of every fraction of a second. There is no delay discharging because the next load of aggregate isn't in the skip as is often the case with a mechanical mixing cycle and when the load is in ahead of time the skip can be raised and held ready for the batchmeter bell.

The power operator starts the skip and turns on the water by power. It takes but a touch of the little finger on the lever and presto—action starts instantly giving the clipped second speed that comes with power operation—but at the correct moment.

See this new MultiFoote device. Let us tell you more about it.

THE FOOTE COMPANY, Inc.
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MULTIFOOTE
The Power with Timken Bearings

All steel construction...
Full circle swing... Three speeds...

and a price that makes is profitable to use a crane

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Truck Crane

Here's the Truck Crane that does a big job for a small investment. Loading trucks or cars . . . digging or filling for road building . . . placing pipe and backfilling . . . handling all loose material. Gears are instantly shifted for light fast work or heavy slow service.

Three-speed, selective-gear transmission, full ball-bearinged automotive construction and material throughout. For hook, bucket or magnet work. Truck or stationary mounting.

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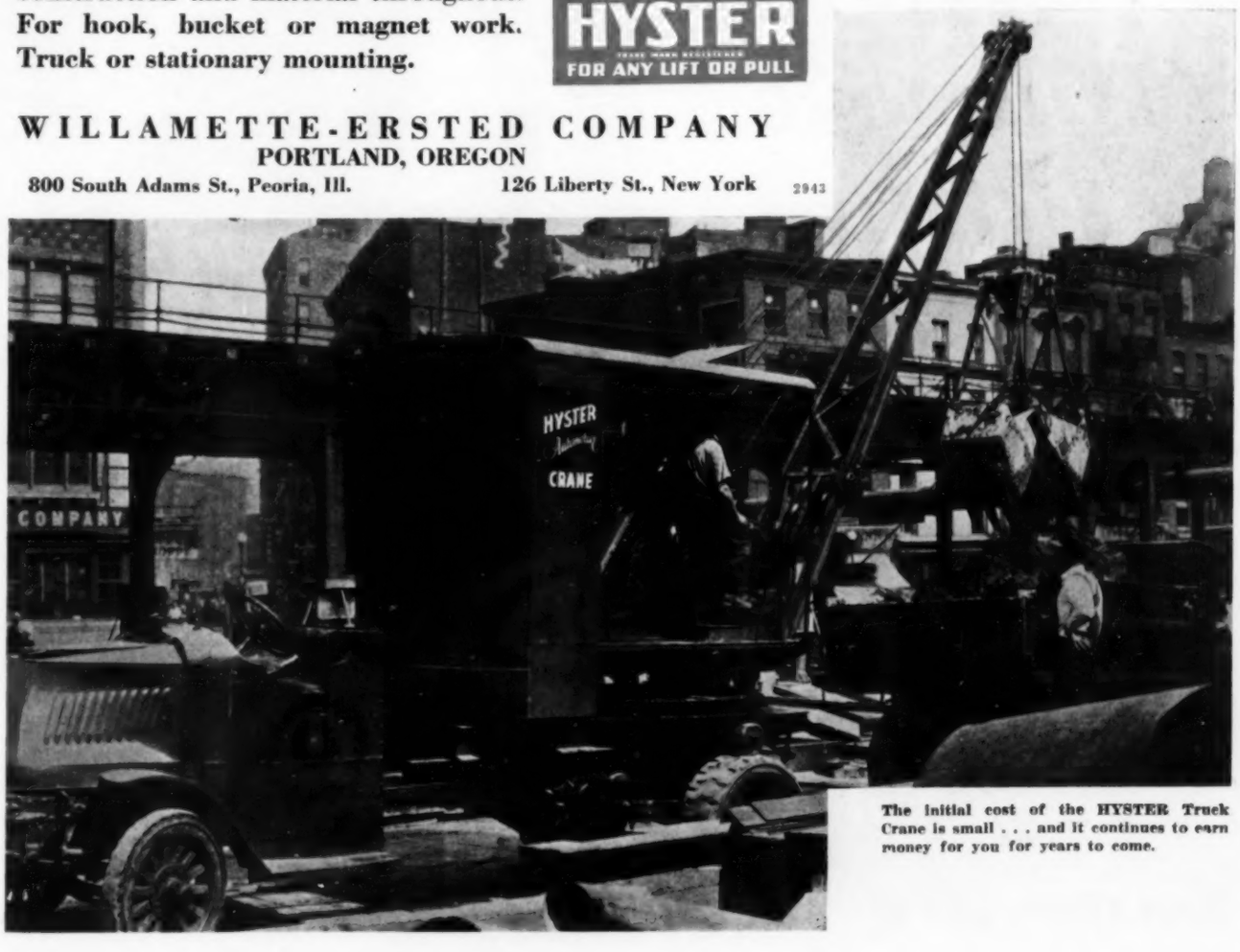
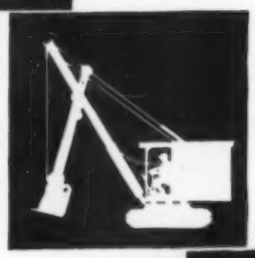
800 South Adams St., Peoria, Ill. **126 Liberty St., New York** 2943



The initial cost of the HYSTER Truck Crane is small . . . and it continues to earn money for you for years to come.

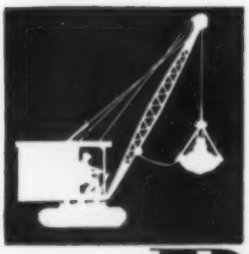


All-Purpose Utility

There is no substitute for the speed and mobility of a Browning Truck Crane. It will go anywhere, do anything, and pay for it-

Setting steel on a subway section in Brooklyn, N. Y., was easy for this Browning Type E Truck Crane.

self out of its earnings. On *any* job it will invariably turn out more productive work at a lower cost.



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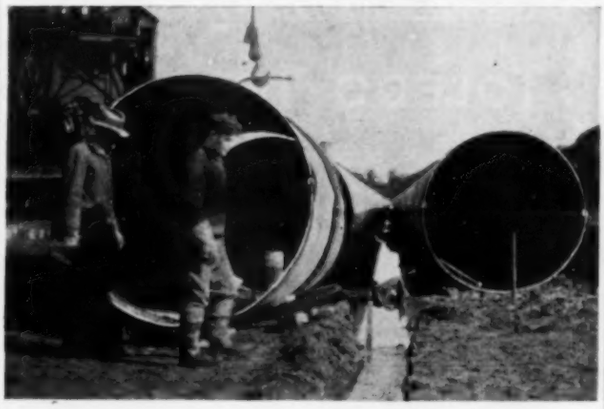

You don't have to wait and see—the test of 25 years proves this joint is dependable

THERE is a wise old fable about a dog dropping a piece of meat in a stream to catch at its reflection. It illustrates a trait of human nature that has perhaps caused more trouble than anything else in the world.

Engineers who know the facts about Lock-Bar Steel Pipe know it is thoroughly dependable—that it has been tried out in important cities all over the continent for the past 25 years with the most satisfactory results. The record is clear. The proof of reliability is conclusive.

Lock-Bar Steel Pipe, with the longitudinal joint strong as the plate itself, is MEAT. When you've got meat in your mouth, why drop it in the stream to catch at a reflection?

The above picture shows some of the 74-inch Lock-Bar Steel Pipe laid for the Wanaque Aqueduct, North Jersey—the largest steel pipe contract for water supply ever awarded in the East.

EAST JERSEY PIPE COMPANY
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LOCK-BAR
Before Closing
STRONG AS THE PLATE ITSELF

DIETZ LANTERNS

VICTOR

USE RED
No Other Color Means
DANGER

A Dependable Hot Blast Square Tube Lantern

ON highway construction jobs the red glow of Dietz Lanterns provides danger signals that are second to none for effectiveness — and unequalled for economy.

A veteran in this service is Dietz "Victor"—a large Hot Blast lantern of square tube design, with a record for dependability.

Dietz Red Globe Lanterns Say "Stop" in every language.

R. E. DIETZ COMPANY
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Largest Makers of Lanterns in the World
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ACCEPT NO SUBSTITUTE

Sterling

--riveted on "extra leg shoes" gives twice the wearing life. "V" braced channel steel legs *eliminate "wobble or shimmy"*

No. 6A—A.G.C. for dry material. Capacity 3½ cu.ft. *All Sterling barrows have reinforced tray tops and corners.* This is the most popular general type barrow.

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No. 6—the *strongest built cart* on the market. Full capacity body, no axle inside. Capacity 6 cu.ft. or 1200 lbs. Perfect balance and easiest wheeling. 42-in. wheels.

The above is but a few of the many, many Sterling types — write for complete catalog. Buy by Sterling name — leading hardware and equipment dealers have them or they can get them quickly from our complete stock warehouses at Chicago, New York, Philadelphia, Pittsburgh, Cleveland, Detroit, St. Louis.

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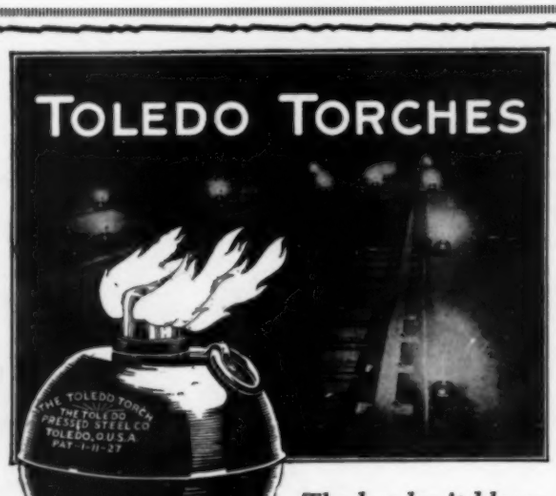
STERLING WHEELBARROW COMPANY

(STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER)

Milwaukee — Wisconsin

TOLEDO TORCHES



The harder it blows the better they burn

Toledo Torches have established a reputation . . . for dependable performance at low cost, that is unequalled by any other safety light made.

Sold by equipment dealers everywhere!

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Toledo · Ohio

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for battered or vertical walls

Clamps may be widely spaced. Inside Rods are surprisingly cheap. Sizes ⅜-in., ½-in., ⅝-in. and tensile strength 7,200, 14,000, and 20,000 pounds. Labor saved in constructing and stripping forms. Clamps permit continuous pouring and give water tight walls, as no metal is left within 1 in. of the surface. Write for full particulars.

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World's Standard HEAVY DUTY

TRAILERS

The Rogers Patented Rocking Wheel Unit, largely responsible for the unprecedented success of these Trailers.

MORE and more, Rogers Trailers are becoming identified with big things—big moving jobs, big profits, big fleets and big contractors, in the sense of having vision and leadership.

Many moving contractors and riggers who started with one trailer, now operate upward to eight units.

Numerous contractors operate their own trailers to save valuable time in transferring machinery; also to avoid the rapid deterioration incident to moving such equipment under its own power.

In some instances, contractors who purchased Rogers Trailers to save money by moving their own machinery, have been able, in addition, to actually pay for the Trailers by serving co-contractors.

The large illustration, drawn from an actual photo, shows one of several transformers moved up Eagle Hill in New Jersey, by R. Doughty for the Public Service Co. of New Jersey.

The complete line of Rogers Trailers, ranging from 5 to 100 tons capacity, is illustrated and described in detail in Catalog No. 28. Write for your copy today.

ROGERS BROTHERS CORPORATION

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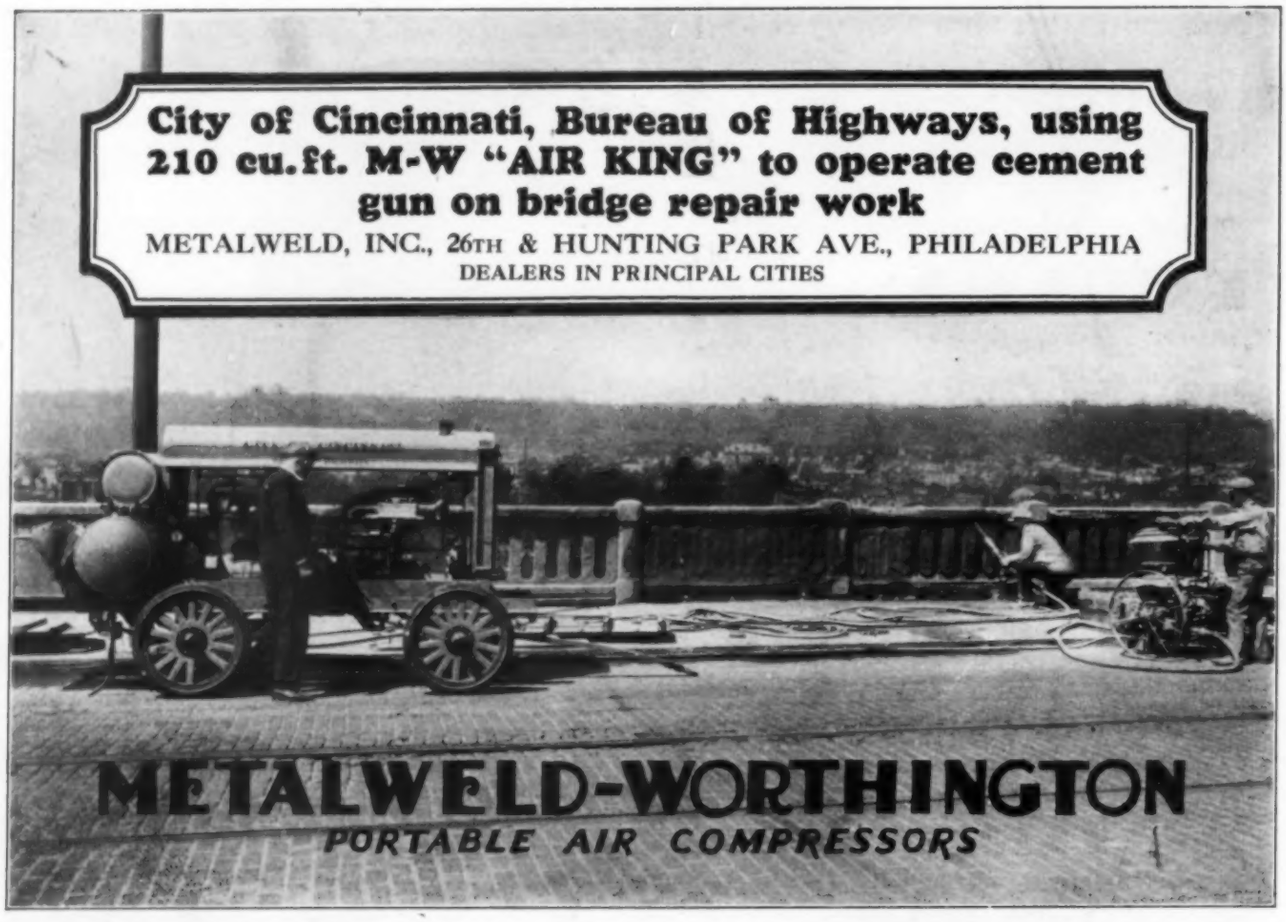

City of Cincinnati, Bureau of Highways, using 210 cu.ft. M-W "AIR KING" to operate cement gun on bridge repair work
METALWELD, INC., 26TH & HUNTING PARK AVE., PHILADELPHIA
DEALERS IN PRINCIPAL CITIES
METALWELD-WORTHINGTON
PORTABLE AIR COMPRESSORS

SCOOP UP PROFITS

A train of three WARCO wheeled scoops and a WARCO power grader working on state route 93 in Ohio.

WITH WARCOS

On hauls running up to 1,000 feet you can't beat a train of WARCO wheeled scoops for low cost dirt moving. One tractor, one or two men and as many scoops as the tractor will pull—usually three or more—will excavate, transport and dump or spread in a continuous cycle without stopping. Dirt has been moved 500 feet for as little as 10 cents per cu. yd. including every item of cost.

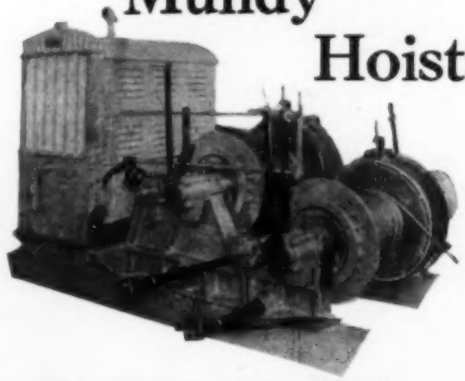
Investigate the WARCO Scoop now—don't delay.

W. A. RIDDELL COMPANY

BUCYRUS OHIO

Graders, Wheeled Scoops, Rear Crawlers for Tractors

Mundy Hoists



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Gasoline—Electric—Steam

Built up to a standard
Not down to a price.

Car Pullers—Cableways

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ESTABLISHED 1869

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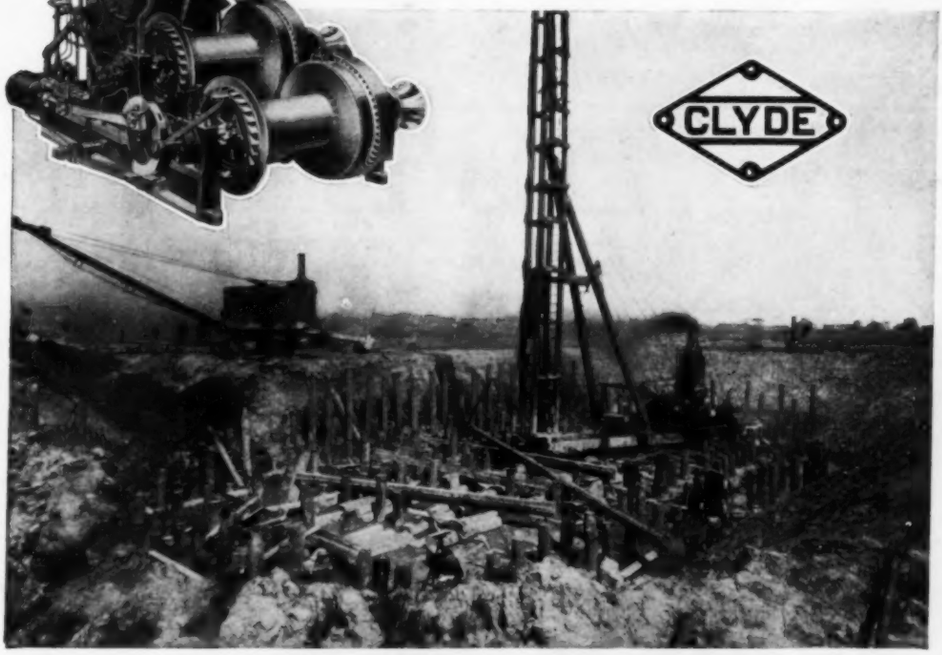
CLYDE HOISTS-DERRICKS

— ten thousand strong —

Proof positive that Clyde hoists and derricks are continually winning more friends and users every day—as well as maintaining their old ones. Such a record, as indicated by the constant repeat orders, is the result of producing equipment that embodies all the best qualities necessary for efficient and lasting service.

In the illustration below is shown a Clyde steam hoist driving piles for Whitney Bros. on a new filteration plant for the City of Detroit. Two Clyde hoists are used on this job, driving around fifteen thousand piles, eighty feet long.



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THE MORETRENCH WELLPOINT SYSTEM

Ground water can be lowered—not much of a trick to it either. *Every proposition planted and pumped according to our instructions has been dried up.* We have dodged nothing. We have dried up foundations for Sewers — large and small — Buildings of all sizes, Sewage Disposal Plants, Loading Manholes on Telephone work, Tunnels, Slides, Conduits, Cofferdams, Dry Docks, Caissons, Power House Intakes, Headings, Bridge Foundations, Locks, Subways (eight in New York), Subaqueous work. Road sub-structures in wet locations—anything and everything.

The Moretrench Wellpoint System makes "Dry" ones out of "Wet" ones under any condition. Send in your proposition.

Moore Trench Machine Company
Rockaway, New Jersey

EISEMANN

The Foremost Magneto

for Construction Equipment

The overwhelming choice of the builders of high quality equipment. Favored by contractors everywhere.

EISEMANN MAGNETO CORPORATION
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4 CYLINDER MOTOR ROLLERS

POWERFUL AND DEPENDABLE AS STEAM
EASY TO HANDLE
SINGLE LEVER CONTROL

MADE IN FOUR SIZES

5 - 7½ - 10 - 12 tons

SEND FOR
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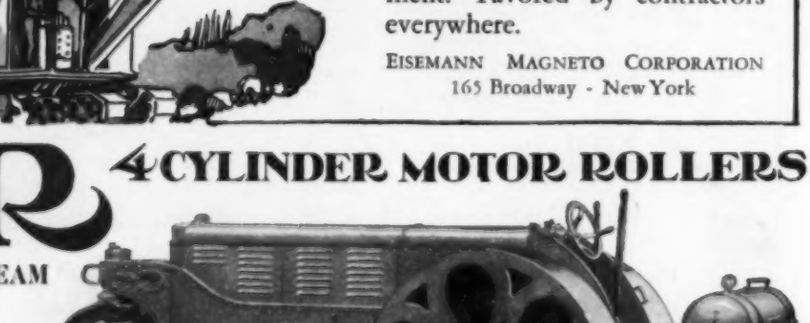

315 E. CENTER ST. **THE HUBER MANUFACTURING CO.** MARION, OHIO

Lackawanna 16 in. x 5 in. Deep-Arch Piling *in* Bulkhead *for* Coal Dock, *Glenwood*, L. I.

Lackawanna Deep-Arch Piling Section DP165, in lengths of 35 feet, was used in the construction of this 450-foot bulkhead.

Because of their high transverse strength and low weight per square foot of wall, Lackawanna Deep-Arch Piling Sections are particularly suitable for bulkhead and dock wall construction.

Two distinct advantages—speed and ease of construction, and low cost when compared with other types of construction of equal life —feature this Deep-Arch Piling Bulkhead.

We shall be glad to give you the benefit of our experience in the use of Lackawanna Steel Sheet Piling. A letter addressed to any of our District Offices, stating your problem, will receive our immediate attention.

BETHLEHEM

BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland, and Honolulu.

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Sole Exporter of our Commercial Products

Mose Is Right . . .

"IF YOU'D always get me chisels like this I never would be broke down!" That's what Mose said about "Clevaloy" Paving Breaker Chisels—and he's right. He runs paving breakers and you can't fool him.

Mose remarked that the first thing he did when he got a new chisel was to see if it had "CRD" stamped on the collar.

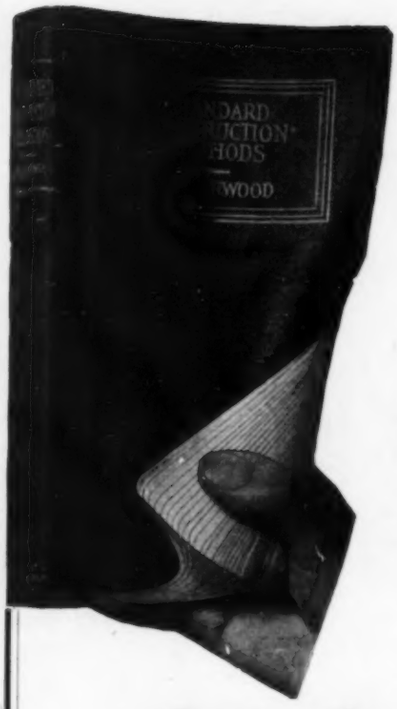
That mark identifies "Clevaloy" and Mose knows when he starts a job with a "Clevaloy" chisel it will *last at least twice as long* as ordinary tools.

Make sure your paving breaker chisels are marked "CRD." It insures long life and lower costs.

Chisels made 1¼-in. and 2½-in. wide, 14-in. and 18-in. long under the collar. The moil-point tool can be had in the same lengths.

The Cleveland Rock Drill Co.
3734 E. 78th St., Cleveland, Ohio
Branches and Distributors in Principal Cities

CLEVELAND ROCK DRILLS



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By G. UNDERWOOD, Construction Engineer

408 pages, 6x9, 327 illustrations, Flexible Keratol
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With an ordinary open end wrench he would have to lift the wrench off after every pull and refit it to the nut. Once a Lowell fits a nut *it stays put*. There's nothing to do but *pump it home*—no time wasted in refitting, just work it back and forth and the job is done.

For speeding up jobs, where bolts must be tightened, there's nothing faster than a Lowell. For over 50 years Lowell Reversible Ratchet Wrenches have been showing their heels to open end wrenches and saving time plus money.

Send for complete catalog R illustrating all types and sizes. Big, special wrenches for special needs.

LOWELL WRENCH COMPANY

Worcester Mass.

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1930 CONVENTION AND ROAD SHOW
JAN. 13–18
ATLANTIC CITY N J

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Manufacturers of road building equipment and materials will display over 500 carloads of their products. The exhibit will be so arranged and co-ordinated with the convention that delegates may attend all sessions and yet have sufficient time to see and compare all the different makes of machinery and materials.

Everyone is invited to attend any committee session in which they may be interested. The committees on highway finance, lien laws, standardization and depreciation of equipment, municipal airports, legislation, grade crossings, traffic and subgrades and pavement bases are among those who will make reports.

This is your Road Show—Attend it—good hotel accommodations—reduced rates on Special trains.

Write to

Charles Upham, *Secy.-Director*
American Road Builders Assn.
National Press Building
Washington, D. C.

Remove Gears, Truck Wheels, Pulleys, etc., this easy way— with CRANE a PULLER!

A Crane Puller will remove ANY kind of Wheel. Here is one way of removing one kind of Wheel.

We like jobs that just "can't be done."

The Crane Puller is a tool for removing any kind of wheel, gear, sprocket, or coupling. Look for next month's ad and see something different.

Write now for circular. Use coupon.

To Crane Puller Co., Waltham, Mass.

Gentlemen:

Show me how gears and wheels can be pulled easily. Quote prices on Crane Pullers. No obligation.

From .....

Address .....

CRANE PULLER COMPANY
Waltham, Mass.

A Sensational Performer and Money Saver

THE speed, versatility, rugged construction, big yardage and low cost of the Fundom combination shovel, ditcher and crane, make it a sensational performer and money saver.

It makes small jobs profitable. Fast, full ¾ circle swing, 1/3 yard dipper capacity, 16½ foot radius, gasoline power.

With Trench Hoe attachment for ditching or Boom Extension for clamshell, dragline or crane, the Fundom is an unbeatable three-in-one digging machine.

Get the details and name of nearest dealer. Address—

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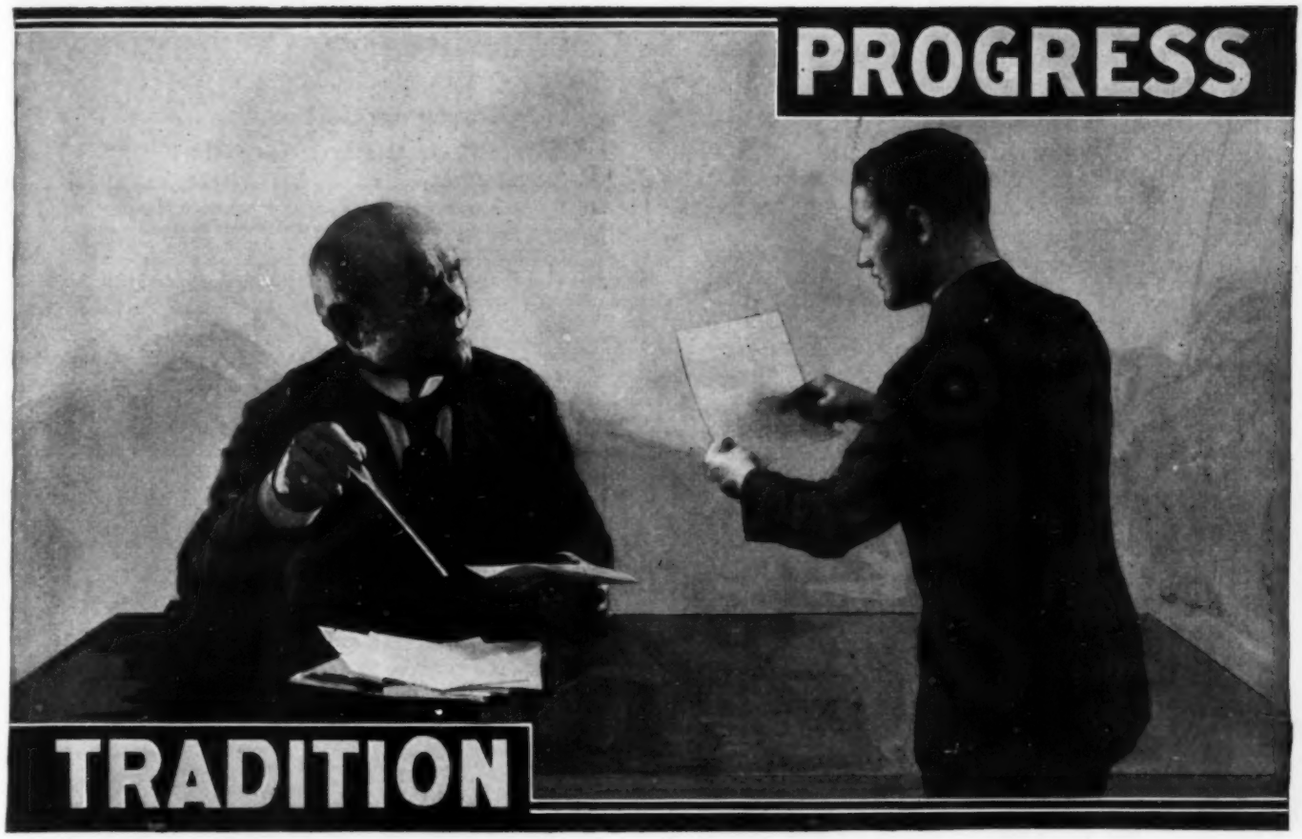

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I'm with you in getting a 'Stable-Arc' welder if you can show me that our prospective work on odd services in construction work will justify it."

The Lincoln "Stable-Arc" Welder

—welds easier
—makes better welds
—permits greater output

because of the steady uniform arc throughout entire welding range, which is the result of:

- **Variable voltage design**
- **Laminated magnetic circuit**
- **Separately-excited generator field**
- **Double control of welding heat**
- **All steel construction**

No other welder has all these features.

"No, Pop—

that's impossible, because you want me to guess the future and our experience to get future business.

And the future will take in all metal joining services, if my guess goes.

I was just reading the report of the Pacific Coast Building Officials' Conference.

It shows where thirty-eight municipalities have incorporated in their building code a section covering the arc welding of buildings.

And various organizations in the Eastern Section have been at work for some time on a building code incorporating a section covering arc welding. When the news breaks, that business will go to those experienced in arc welding.

Our experience is never gained on work we're *going* to do."

The Lincoln Electric Co.
Dept. No. 32-11, Cleveland, O.

W-113

LINCOLN "Stable-Arc" WELDER

A Watson-Stillman Hydraulic Bender Bending Conduit Pipe for Subway Work. Note the economy of Labor.

DO YOU BEND MUCH PIPE?

If you do you need a

Watson-Stillman Hydraulic Pipe Bender

These machines are not only rapid and economical of labor, but the bends are made uniform and without danger of buckling or crushing.

We build pipe benders in a variety of types and sizes as well as a full line of Hydraulic Machinery including jacks, pumps, accumulators, presses, shears, etc.

Write for catalogs.

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ABILITY to lead means the possession of those qualities that men recognize as superior. *Nothing else* makes leadership.

From coast to coast, wherever new roads are being made or present ones repaired, Buffalo-Springfield Road Rollers are the choice of the men on the job. Advanced design and superior performance make these rollers widely accepted as leaders worthy of the name.

Various steam and motor designs in all practical sizes. Attachments when desired. Interesting booklet on request.

The Buffalo-Springfield Roller Co.

Springfield, Ohio

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The "Universal" is an Accurate Steel Tape at a popular price. Line is ⅜-in. wide, standard weight. Case is sturdy, and of good appearance.

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Our Folding Aluminum Rules are furnished with or without hook. All joints and fittings are solid brass, making the rule rust-proof throughout.

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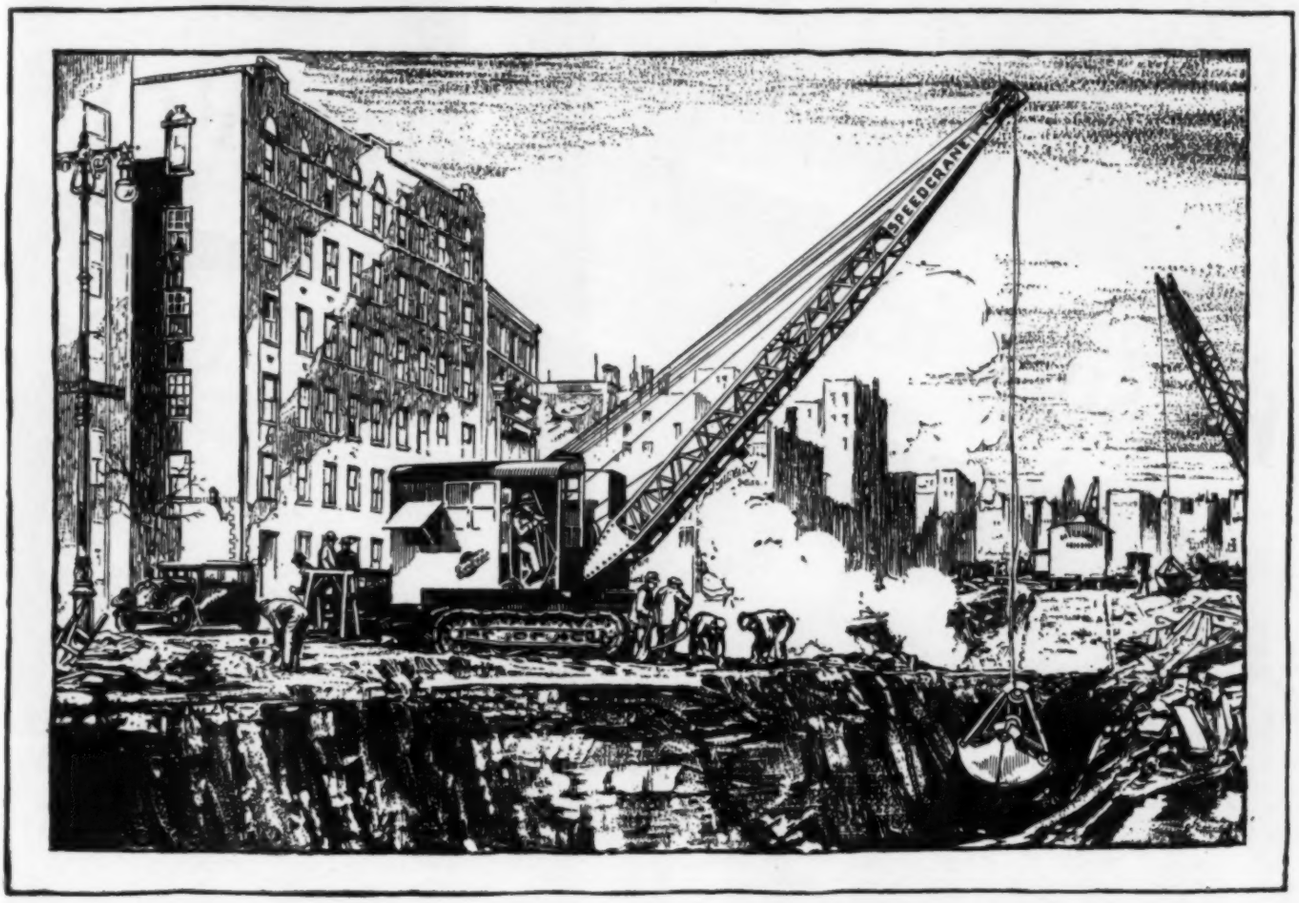
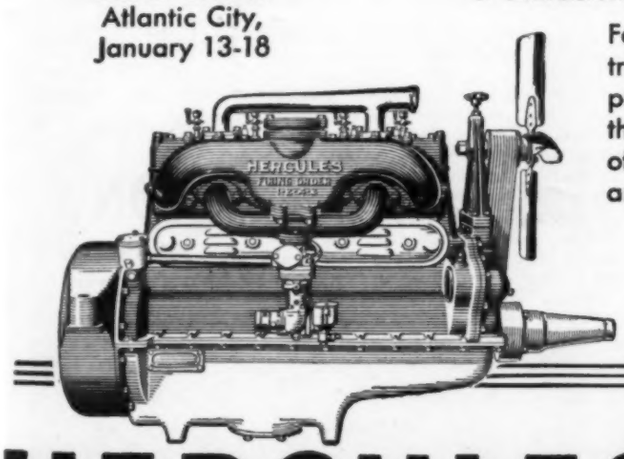
New York - Windsor, Ont.

Working Both Day and Night to Dig New York's New Subway



Three Moore Speedcranes, sturdily powered by Hercules Heavy-Duty Engines, frequently worked double shifts during their eight months on the job of digging the New York Concourse subway between 160th and 175th Streets. Throughout the entire eight months there was not a five-minute delay—a characteristic example of Hercules reliability.

Hercules will exhibit at the 1930 A.R.B.A. ROAD SHOW Atlantic City, January 13-18



For excavation work and other heavy-duty contracting jobs, Hercules Engines can always be depended upon. Flexible, powerful and economical, they are the outstanding choice of manufacturers of shovels, road building machinery, trucks, tractors and other power equipment.

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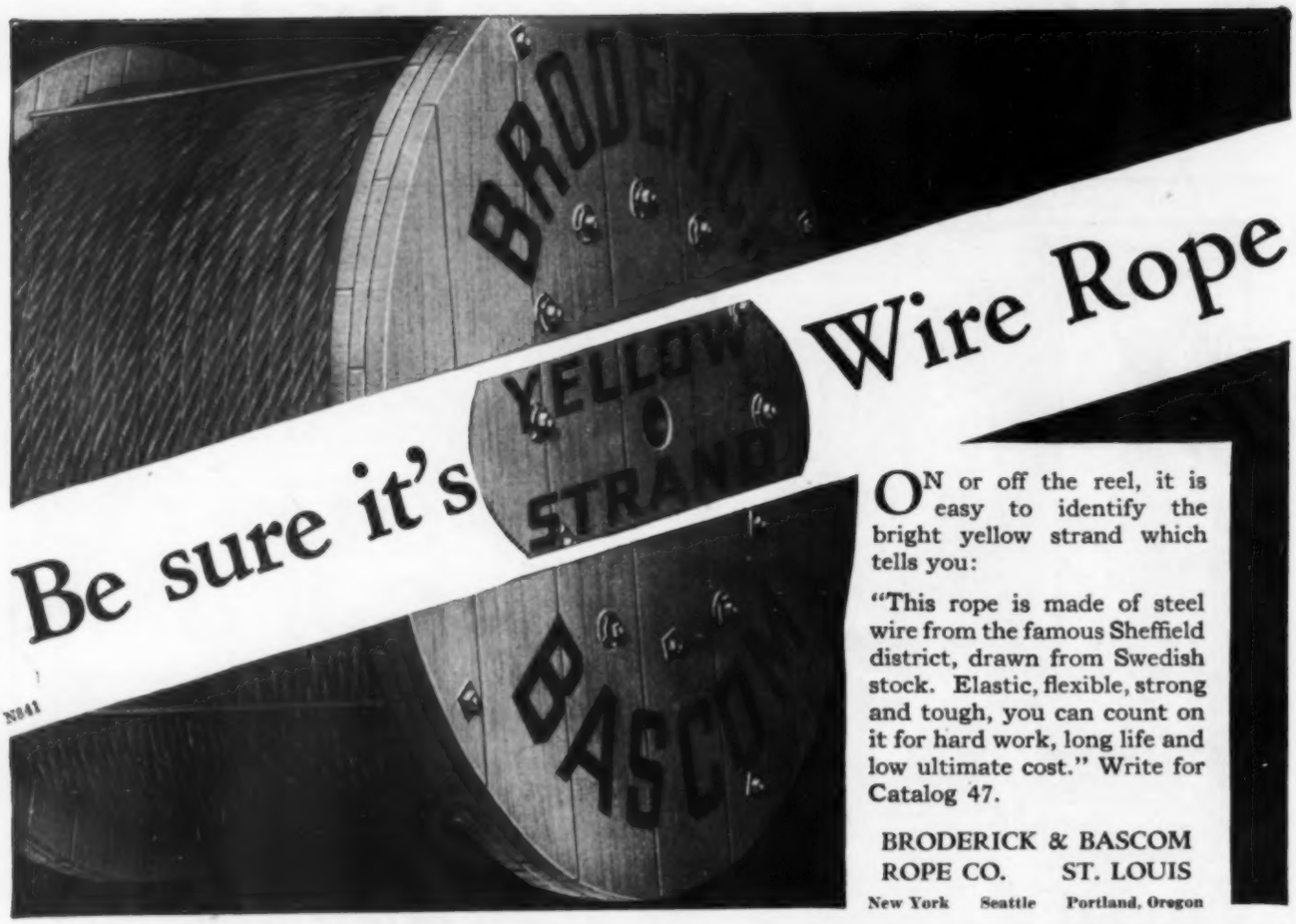
WEST COAST BRANCH: LOS ANGELES, CAL.
MID-CONTINENT BRANCH: TULSA, OKLA.

HERCULES ENGINES



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ON or off the reel, it is easy to identify the bright yellow strand which tells you:

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It can be used in the laboratory, at the sand bank or on the job. *Send for booklet "About Sand."*

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Circular 86-W tells the whole story.

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"CATERPILLAR" Tractors will play a famous part in the Southern Pacific Company's $12,000,000 bridge. Material from the bridge site is dumped from cars along the present right of way—the Sixty bulldozes it over the edge. There are huge gasoline tanks to be moved—a score of chores at which the "Caterpillar" track-type Tractor lends willing and powerful help.

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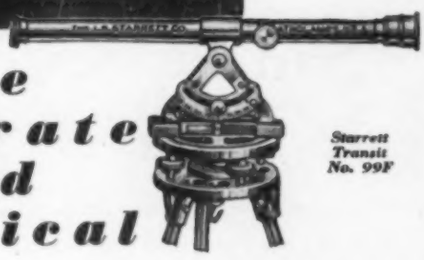

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Inexpensive, Can Be Set Up or Knocked Down in a Jiffy!!

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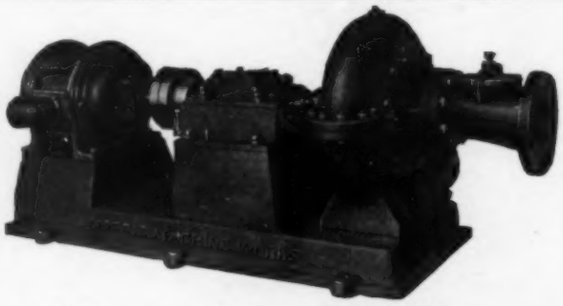
THE JAEGER MACHINE CO. 800 DUBLIN AVE. COLUMBUS, OHIO



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for handling raw sewage, pulp, trash, liquids holding semi-solids, etc.

These units have surprising ability to pass large solids. They stop the clogging nuisance, are extremely efficient and have extra heavy wearing parts that minimize renewal expenses.

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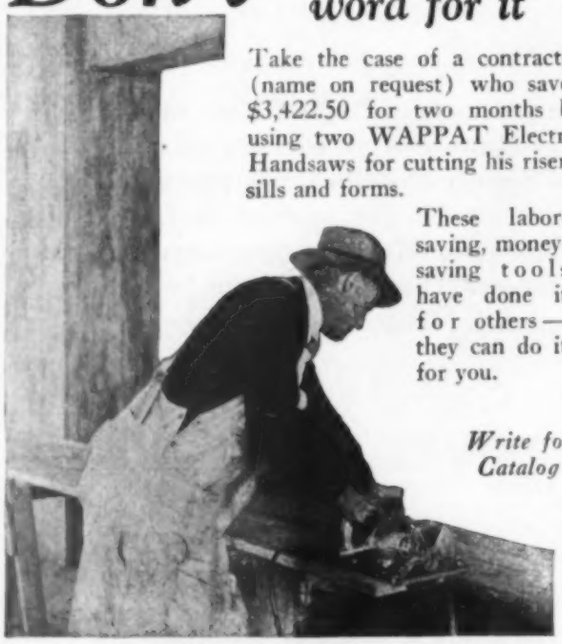

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These labor-saving, money-saving tools have done it for others—they can do it for you.

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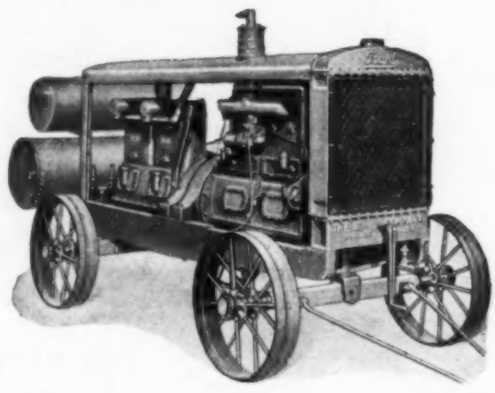
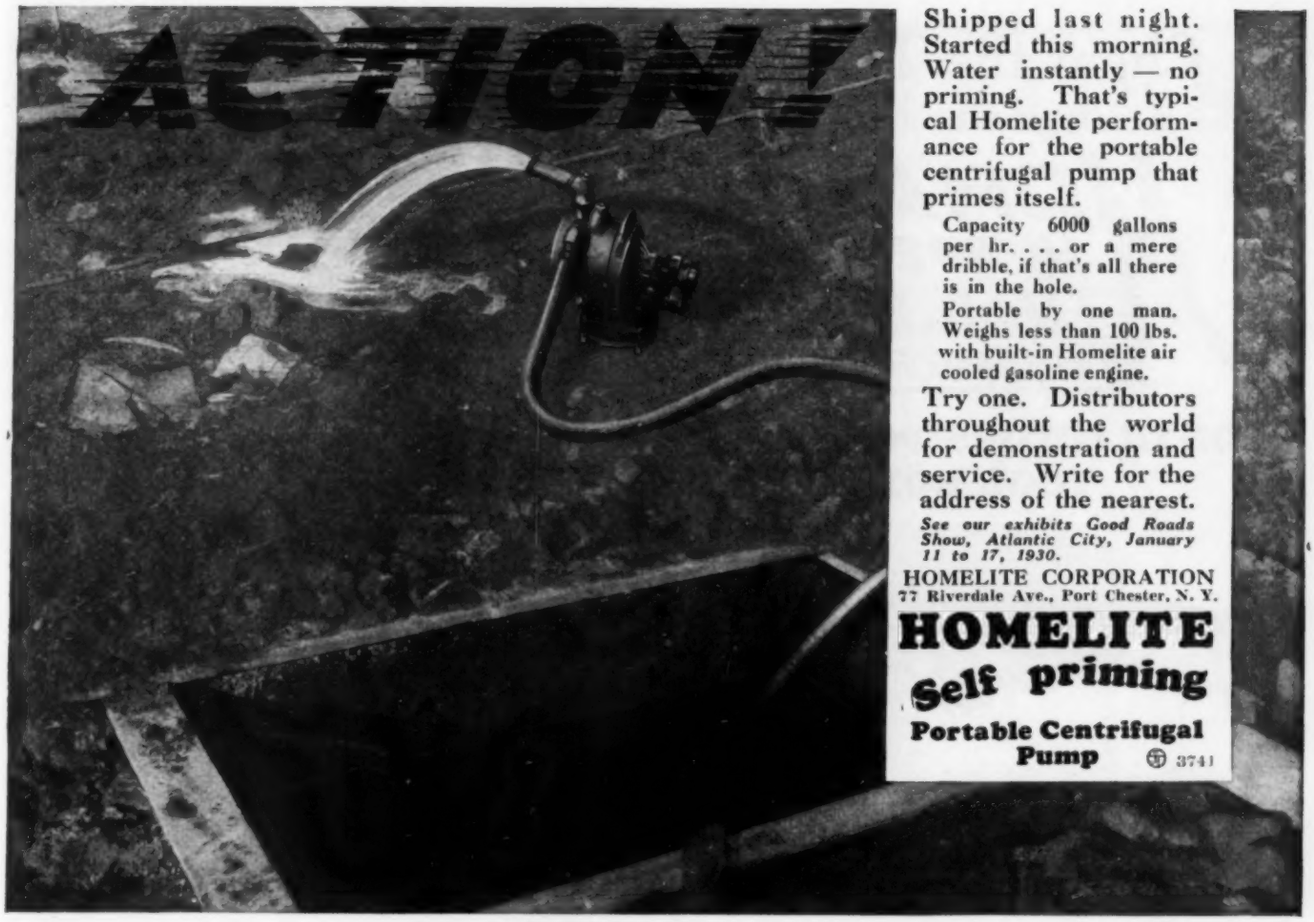


Investigate the BUHL portable compressor because it is "Years Ahead" in design. It embodies many exclusive, patented improvements that result in unusual economy, dependability and long life. Many of the leading concerns in the country are enthusiastic users. BUHL Portable Compressors are obtainable in 36, 55, 90, 100, 110, 220 and 330 cubic feet capacities and with any mounting desired.

Descriptive Bulletins on Request

The *Buhl* Company

Old Colony Building, CHICAGO



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Capacity 6000 gallons per hr. . . . or a mere dribble, if that's all there is in the hole.

Portable by one man. Weighs less than 100 lbs. with built-in Homelite air cooled gasoline engine.

Try one. Distributors throughout the world for demonstration and service. Write for the address of the nearest.

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HOMELITE
Self priming
Portable Centrifugal Pump 3741

BAKER

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BAKER MANEY SCRAPERS

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HOOK IT TO THE TRUCK AND
STEP ON THE GAS

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Positive release device on friction lever.

Gasoline or electric motor.

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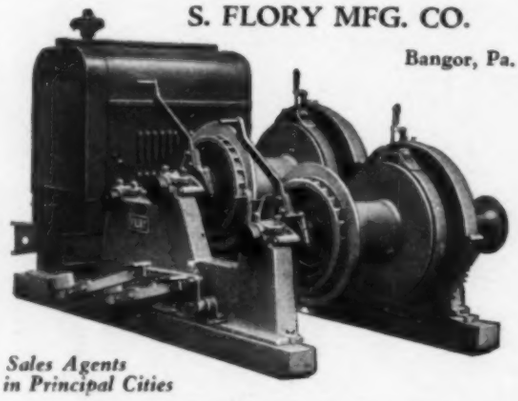
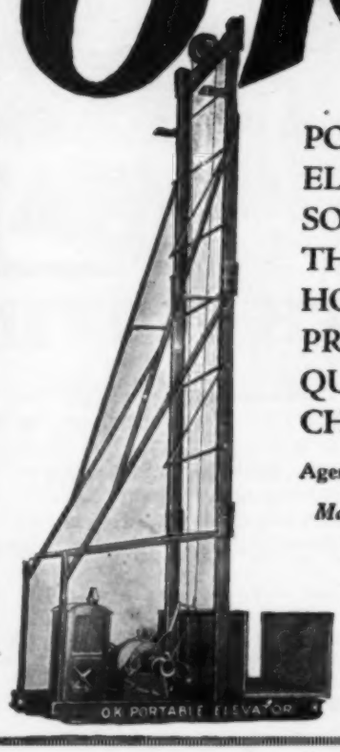


Sales Agents in Principal Cities

O.K.



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Agents—get our proposition.

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O.K. Clutch and Machinery Co.
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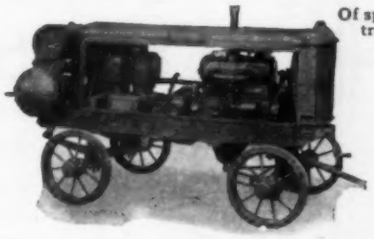
Mounted on Chassis frame of 1½ ton truck.



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Factory: Hackensack, N. J.

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C.M.

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Of Construction Methods, published monthly at New York, N. Y., for Oct. 1, 1929.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared C. H. Thompson, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Co., Inc., publishers of Construction Methods, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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McGRAW-HILL PUBLISHING COMPANY, INC.
C. H. THOMPSON, Secretary.

Sworn to and subscribed before me this 30th day of September, 1929.

[Seal.] H. E. BEIRNE.

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Big YARDAGE —Small Shovel —Close quarters

A BAY CITY Tractor Shovel with short boom for tunnel work, is excavating the approach to the International Tunnel between Detroit and Windsor. Illustration shows the machine working forty feet below street level—before the job is completed, it will burrow its way down to a final depth of 95 feet, through a blue clay of exceptionally sticky and gummy nature.

A big job for a small shovel but the BAY CITY is there with the goods. This husky little digger was averaging 25 truck loads per hour, when on May 29 it made a record of 260 truck loads in a ten hour day. Since then, the little fellow has been placed on a 22 hour day basis, operating two shifts of eleven hours each.

Capacity is limited not only by the crowded working conditions and by the exceptionally sticky nature of the material but also by the trucks. Five trucks are being used. They are obliged to back down all the way into the tunnel to get in position.

BAY CITY performance on this job has been so remarkable that it has attracted the attention of many engineers—if you haven't been there to see it yourself, ask Colwell Bros., Detroit—the sub-contractors and owners of the machine pictured above—or get in touch with our nearest distributor for a demonstration.

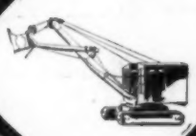
BAY CITY SHOVELS, Inc.

New York Office—302 Broadway BAY CITY, MICH.

BAY-CITY

The BAY CITY family of fast workers

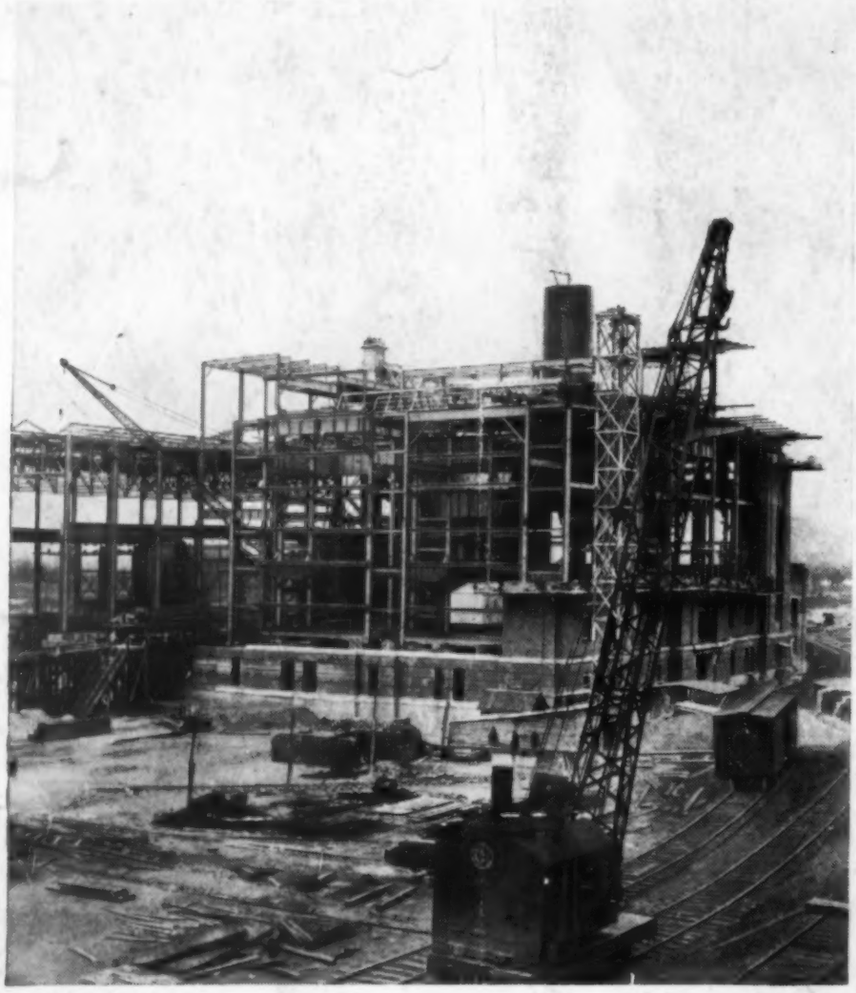
MODEL R
A 26-ton, heavy duty, full revolving ¾-yd. shovel, crane or dragline.



MODEL K
Full revolving light ½-yd. convertible shovel. Weighs 13 tons.

TRACTOR SHOVEL
Recognized leader in its field. Operates shovel, Trench hoe, backfiller, etc. Weighs 10 tons.

STRUCTURAL STEEL CREATED THE SKYSCRAPER



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Steel is everywhere making possible a greater refinement in building design. Its immense strength and permanent security permit a wider scope of imagination in the search for means to express the modern spirit . . . not only in tall skyscrapers and huge bridges, but in small apartment houses, dwellings and small bridges as well.

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